THE IMPACT OF HIGH-LEVERAGE HOME LOANS ON RACIAL/ETHNIC SEGREGATION AMONG HOMEBUYERS IN THE MORTGAGE BOOM

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LIST OF ABBREVIATIONS

2SLS two stage least squares

ABS asset-backed security

ACS American Community Survey

AHS American Housing Survey

APR annual percentage rate

ARM adjustable rate mortgage

CDBG Community Development Block Grant

CDFI Community Development Financial Institutions

CFPB Consumer Finance Protection Bureau

CLTV combined loan-to-value

CRA Community Reinvestment Act

ECOA Equal Credit Opportunity Act

FaHA Fair Housing Act

FDICIA Federal Deposit Insurance Corporation Improvement Act

FHA Federal Housing Administration

FHEFSSA Federal Housing Enterprises Financial Safety and Soundness Act

FHFA Federal Housing Finance Agency

FIRREA Financial Institutions Reform Recovery and Enforcement Act

GSE government-sponsored enterprise

HMDA Home Mortgage Disclosure Data

HOEPA Home Ownership and Equity Protection Act

HOLC Home Owners Loan Corporation

HUD Department of Housing and Urban Development

LTV loan-to-value

MSA metropolitan statistical area

NHW non-Hispanic white

OLS ordinary least squares

PTI payment-to-income

SUMMARY

Residential racial segregation has been perennially viewed as a major urban problem in the United States. Meanwhile, the single-family mortgage market has been an influential factor in determining segregation since at least the 1930s. Although many prior studies rightly have focused on the very real individual and social costs of subprime loans and related loan features, the greater leverage they afford also may have allowed some, especially minority, homebuyers to purchase properties they otherwise would not have been able to afford. Limited loan-to-value and payment-to-income ratio requirements have constrained borrowers from prime, conventional lenders, and relaxing these standards might allow some borrowers to purchase more expensive homes, possibly in higher quality neighborhoods.

Additionally, if minority borrowers disproportionately obtained high-leverage loans, the effect of these loans on neighborhood choice may be greater for minorities than non-Hispanic whites. Since higher-quality neighborhoods are disproportionately non-Hispanic white or racially diverse, the increase in high-leverage mortgages might mitigate the neighborhood quality gap between minorities and non-Hispanic whites and reduce levels of racial/ethnic segregation. Accordingly, this dissertation focuses on two research questions: 1) whether high-leverage home purchase loans enabled borrowers to purchase more expensive homes and homes in higher-quality neighborhoods; and 2) whether these loans affected the racial/ethnic segregation of homebuyers at the metropolitan level. Since blacks and Hispanics comprise significant minorities in many

metropolitan areas in the 2000s, I examine the questions for three racial/ethnic groups: non-Hispanics whites, blacks, and Hispanics.

To answer the first question, household housing demand and neighborhood quality models are estimated using the American Housing Survey data. To answer the second question, metropolitan area segregation models are estimated primarily using the American Community Survey and the Home Mortgage Disclosure Act. Both cross-sectional and fixed-effect panel segregation models are estimated using a two-stage least squares approach with chosen instruments.

I find that the use of high-leverage loans increases housing demand and neighborhood quality, holding other household characteristics constant. I also find that high-leverage loans have a substantial, negative effect on black segregation, while the effect on Hispanic segregation is somewhat ambiguous. The findings suggest that policymakers should consider the impact of regulations affecting allowable loan-to-value and payment-to-income ratios on borrowers' residential choice and urban form, as well as on default risk.

CHAPTER 1
INTRODUCTION

The policy debate surrounding the subprime mortgage crisis generally has centered on the costs and risks of subprime mortgage lending to households and neighborhoods. Many prior studies rightly have focused on the very real individual and social costs of subprime loans and related loan features, including their effects on default and foreclosure rates, the resulting foreclosures effects on neighborhoods, and the steering of prime borrowers to subprime loans (Ernst, Bocian, & Li, 2008; Goodman & Smith, 2010; Immergluck & Smith, 2005, 2006a, 2006b; Pennington-Cross & Ho, 2006; Quercia, Stegman, & Davis, 2007; Renuart, 2004; Rose, 2008). However, notwithstanding the considerable harm that subprime loans may impose, the greater leverage (higher loan-to-value and payment-to-income ratios) they afford also may have allowed some homebuyers to purchase properties they otherwise would not have been able to afford, including homes in neighborhoods with more economic opportunity, such as those with better public services and transit, lower poverty rates, and better schools. When we consider minorities' much greater reliance on subprime loans and the correlation between better neighborhoods and neighborhoods' white proportion, the greater leverage might also affect racial segregation in our metropolitan areas. Although in a highly deregulated subprime market that permits predatory lending practices and excessive foreclosure rates, an increase in access to credit may have obvious downsides, a more cautious expansion of responsibly underwritten, high-leverage loans actually may benefit certain low- and moderate-income buyers.

Residential racial segregation has been perennially viewed as a major urban

problem in the United States. Studies on racial segregation have shown that it has negative effects on the quality of life and economic opportunity, including educational attainment, employment, and health (Coleman et al., 1966; Condron, Tope, Steidl, & Freeman, 2013; Kain, 1968; Stoll & Raphael, 2000; Subramanian, Acevedo-Garcia, & Osypuk, 2005; Wells & Crain, 1994). Coleman and his colleagues (1966) and Wells and Crain (1994) found that the racial composition of school districts explains both school and occupational achievement. Condron and his colleges (Condron, et al., 2013) also found that various types of state level racial segregation negatively affect school achievement. Kain (1968) found that racial segregation affects the distribution of black employment and reduces blacks' job opportunities. Stoll and Raphael (2000) also found that over half of the mean racial and ethnic differences in the quality of spatial job search are explained by racial segregation. Subramanian (2005) and his colleagues found that racial segregation negatively affects blacks' self-rated health status, but not whites'. In sum, racial segregation generates harms to very important aspects of the quality of life of minority population and exacerbates racial inequality.

Policymakers, therefore, should be wary of overly restrictive credit – of the pendulum swinging too far in the direction of less access – due to the potential for greater racial segregation and other spatial implications. Increased access to loans with higher payment-to-income (PTI) and/or higher loan-to-value (LTV) ratios has the potential to result in lower levels of racial segregation, especially when such segregation arises, in part, from income or wealth constraints. Of course, if such loans entail excessive foreclosure risk, any racially integrative effects may be short-lived, and the negative impacts of foreclosure may do substantial harm to borrowers and their communities.

This topic is particularly timely as federal regulators, lenders, and consumer advocates currently debate the potential impacts of various lending and securities regulation that could directly affect access to high-leverage home loans. In two such policy debates – concerning the definition of a "qualified mortgage" and the definition of a "qualified residential mortgage" – policymakers are determining measures that may affect the accessibility of high-leverage loans with little to no consideration for the urban spatial implications of these regulations. Moreover, policymakers will be revisiting these definitions over time, repeatedly considering proposals to loosen or tighten thresholds and to redefine what constitutes a high level of leverage in home loans.

The Consumer Finance Protection Bureau (CFPB) recently released its final rules on qualified mortgages, which require mortgage lenders to consider consumers' ability to repay their home loans at the time of origination. A lender that originates loans satisfying the regulatory definition can argue that it properly considered the consumers' ability to repay in any future lawsuit. Under these rules, however, stated-income and/or stated-assets loans cannot be considered qualified mortgages, and loans with negative amortization, interest-only payments, balloon payments, or terms exceeding 30 years generally cannot be qualified mortgages. Nevertheless, the CFPB imposed no overly restrictive rules on LTV or PTI ratios.

The more intense debate focuses on the definition of qualified residential mortgages, which determines the privately-securitized mortgages that are exempted from minimum five percent credit risk retention requirements. Consequently, loans falling outside the definition entail much higher costs. Various interest groups have debated the inclusion and thresholds of LTV and PTI ratios in the definition of a qualified residential

mortgage.. Although an obvious benefit of decreased default probability exists with a low-leverage threshold, both industry and consumer advocates have expressed concerns about any restricted flow of mortgages, especially for low- and moderate income families (Holtz-Eakin, Smith, & Winkler, 2012; Quercia, Ding, & Reid, 2012). Nowhere in this debate, however, have the spatial implications, such as racial residential segregation, been considered. If planners and researchers fail to act with foresight on this issue, we may lose a vital opportunity to positively influence long-term spatial structure. When experts did not recognize the implications of the Federal Housing Agency's lending policies in the 1930s, they lost a similar opportunity to direct the debate. (Immergluck, 2004; Massey & Denton, 1993).

Housing scholars have considered the implications of mortgage policies and mortgage types on racial segregation since the 1990s. The strong economy and moderate interest rates, together with legislative and regulatory changes in the 1990s, generated large increases in loans to low-income and minority households (Scheessele, 1999), and several researchers examined the impacts of these changes on racial segregation (Duda, 2005; Duda & Belsky, 2001; Immergluck, 1998; MacDonald, 1998; Stuart, 2000). Although these researchers reported some improvement in racial integration among homebuyers, most did not provide strong evidence of a causal relationship. Two other studies, however, furnished stronger proof of the effects of certain types of mortgages. Bond and Williams (2007) found a desegregation effect from mortgages provided by traditional lenders but no significant effect from subprime mortgages. Friedman and Squires (2005) found a positive effect from loans regulated by the Community Reinvestment Act (CRA) on the share of minority buyers in predominantly white

neighborhoods. In the 2000s, however, the substantial increase in minority homeownership was largely attributable to the prevalence of subprime loans, primarily originated by lenders not regulated by the CRA or by independent mortgage companies. The subprime loans in the 2000s also differed from those in the 1990s in that the share of subprime loans in the home purchase market grew substantially and the loan features of subprime loans changed significantly. This study aligns with previous research on the impacts of the mortgage market on racial segregation but anticipates that the desegregation effect will be driven by a different cause, namely, the prevalence of mortgages with high LTV and/or PTI ratios, or referred to herein as "high-leverage" home loans.

Existing LTV and PTI ratio standards have constrained borrowers from prime, conventional lenders, and relaxing these standards might allow some borrowers to purchase more expensive homes, possibly in higher quality neighborhoods. Additionally, if minority borrowers disproportionately obtained these high-leverage loans, the effect of these loans on neighborhood choice may be greater for minorities than non-Hispanic whites. Since higher-quality neighborhoods are disproportionately non-Hispanic white or racially diverse, the increase in high-leverage mortgages might mitigate the neighborhood quality gap between minorities and non-Hispanic whites and reduce levels of racial/ethnic segregation. Accordingly, this dissertation examines whether high-leverage loans affect the racial/ethnic segregation of homebuyers in the U.S. metropolitan areas. Although the subprime loans of the middle 2000s may not represent the ideal form of high-leverage loans, given the excessive foreclosure risk and sometimes predatory nature they exhibited, their high PTI and LTV features – together with their sheer volume –

should reveal any short-term spatial impacts that high-leverage lending might have on segregation and urban form. Thus, subprime loans are used as a proxy in this dissertation for high-leverage loans. Most subprime loans are expected to exhibit high PTI and LTV features, and although these features may increase default risk to some degree, research has also shown that high-leverage, by itself, does not mandate a dramatic effect on foreclosure risk (Quercia, et al., 2012).

The characteristics of subprime loans in the 2000s changed from those in the 1990s. While the subprime loans in the 1990s were primarily for credit-impaired borrowers and tended to have low LTV ratios, those in the 2000s exhibited many characteristics other than low credit scores to distinguish them from prime loans. Industry data demonstrate that credit score gaps between prime and subprime loan pools were substantially narrowed during the 2000s, and the more prominent features of the subprime loan pool were high LTV and PTI ratios, at least at the peak of the mortgage boom (Chomsisengphet & Pennington-Cross, 2006; Foote, Gerardi, Goette, & Willen, 2008). Since information on LTV and PTI ratios are not available in public data, I will use high-priced loans identified in Home Mortgage Disclosure Data (HMDA) from 2005 through 2007, as a proxy for high-leverage loans. I also assume that the primary risk factor for high price loans during this period was high LTV and/or PTI ratios.

Nevertheless, by employing high-priced loans as a proxy for high-leverage loans this analysis is not ignoring the downside of excessively risky and potentially predatory subprime loans. Rather, the subprime mortgage boom represents the only period in which lenders made high-leverage home purchase loans in a sufficient quantity to affect metropolitan segregation levels. Moreover, high-leverage lending can be done – and, in

fact, has been done, albeit on a limited scale – in a manner not involving excessively high interest rates, high fees, and predatory lending features such as heavy prepayment penalties. High-leverage lending also can be done more prudently by requiring full loan documentation and incorporating pre-purchase loan counseling and the like to minimize underwriting risks (Quercia, Freeman, & Ratcliffe, 2011). High-leverage loans can benefit low-income, minority homebuyers only if these loans are originated without predatory features and excessive risk taking. This dissertation focuses on the initial effect of high-priced loans – desegregation caused by high-leverage – while other studies have focused on the eventual effect of these loans – foreclosures caused by predatory and poor underwriting practices.

Chapter 2 of this dissertation reviews the literature on mortgage market changes in the 1990s and the 2000s and the impact of high-leverage loans on neighborhood quality and racial segregation. Chapter 3 presents the research question and proposes the hypotheses of this study. Chapter 4 examines the effect of high-leverage loans on neighborhood quality with the American Housing Survey data. Chapter 5 examines the effect of high-leverage loans on racial/ethnic segregation with the Home Mortgage Disclosure Act and American Community Survey data. Chapter 6 summarizes the results and suggests policy implications.

CHAPTER 2
HOMEBUYERS' SEGREGATION SINCE THE 1990S

Because the vast majority of families need financing to purchase homes, mortgage markets may have major impacts on residential patterns such as racial segregation. Moreover, since mortgage markets can reflect people's or customers' attitudes on race and preference for living environments, they can be facilitating instruments of majority groups' values. The mortgage industry has contributed to racial segregation at the beginning of, and during the large-scale development of, entrenched segregation patterns in the U.S..

Describing the formation of urban black ghettos, Massey and Denton (1993) showed lenders' participation in confining blacks in these neighborhoods. Black ghettos started being formed in the early 20th century when blacks migrated into cities, especially northern ones. The large scale influx of poor blacks from southern rural areas triggered white hostility, and whites started to segregate blacks using both violent and non-violent tactics such as racially restrictive covenants. White realtors and lenders did not permit blacks to move in white neighborhoods. With "blockbusting", some realtors and lenders deliberately allowed blacks to move in border neighborhoods, generating panic among white neighbors and subsequent white departure from the neighborhood. This generated profits from selling homes to blacks at high prices with high interest rates.

The confinement of blacks in ghettos and whites' persistence in maintaining this color line continued in subsequent periods. Explaining the suburbanization of U.S. cities from the older walking city to the present, Jackson (1987) described the impact of mortgage markets on suburbanization and segregation in the post-war era. In 1933, the

Home Owners Loan Corporation (HOLC) was created to refinance mortgages at the risk of default or foreclosure by introducing the long-term, fully-amortizing loans with fixed monthly payments. The HOLC's important influence was to provide a formal and uniform appraisal scheme including a government-sanctioned neighborhood rating system across the nation, reflecting the industry's practices. In this rating system, the mortgage industry's disfavor for dense, old, and racially-mixed neighborhoods was well expressed. Later, this appraisal system was adopted by the Federal Housing Administration (FHA), which provided government-insurance for 11 million families by 1972. Since the FHA's insurance greatly reduced the affordability of homeownership, its influence on the residential location was also substantial. Consequently, FHA had a great impact on residential patterns. By formally stating the neighborhoods with dense and old structures, and those with non-white residents as risky neighborhoods in which to invest, the FHA endorsed and strengthened the mortgage industry's preferences for suburbanization and racial segregation.

Following a series of federal laws attempting to address racial discrimination and disinvestment in minority neighborhoods, which are briefly introduced in the next paragraphs, segregation has only slowly been reduced. This chapter describes the general mortgage market environment in the 1990s, focusing on regulatory change, and in the 2000s, focusing on changes in the mortgage industry. The chapter also reviews the research on homebuyers' racial and ethnic segregation since the 1990s and related research on mortgage markets. The chapter concludes with a discussion of the expected impact of high-leverage loans on neighborhood location choice and segregation, which will be more fully addressed in Chapter 3.

Changes in the Mortgage Market in the 1990s

In the 1990s, the Community Reinvestment Act (CRA) and the Home Mortgage Disclosure Act (HMDA) were significantly enhanced by amendments and changes in regulations. The purpose of the CRA is to "encourage depository institutions to help meet the credit needs of the communities in which they operate, including low- and moderate-income neighborhoods (Federal Financial Institutions Examination Council, 2009a)." To fulfill this purpose, the legislation tasks four federal regulators with the job of examining the performance of an institution, and these regulators can deny its application for business expansion based on a poor CRA evaluation.[1] With the passage of the Financial Institutions Reform Recovery and Enforcement Act (FIRREA) of 1989, CRA reports and ratings from these evaluations became publicly available, pressuring both lenders and examiners to improve their CRA performance (Garwood & Smith, 1993). The CRA was subsequently modified to focus more on actual lending outcomes and to require consideration of lenders' compliance with fair lending laws in assessing their performance. In 1995, federal regulators also revised CRA regulations to emphasize lending outcomes over processes such as community outreach efforts. The overall CRA rating includes scores from three test domains: lending, investment, and services, with more emphasis on the lending score. After 1995, when examiners assigned lending scores, they started counting loans to low- and moderate-income individuals as well as loans to low- and moderate-income census tracts (Friedman & Squires, 2005).

[1] These regulators are the Federal Reserve Board, the Federal Deposit Insurance Corporation, the Office of the Comptroller of the Currency, and the Office of Thrift Supervision.

The purpose of the HMDA is "to provide public loan data to assist in determining whether financial institutions are serving the housing needs of their communities, in distributing public-sector investments so as to attract private investment to areas where it is needed, and in identifying possible discriminatory lending patterns (Federal Financial Institutions Examination Council, 2009b)." The FIRREA amended the HMDA to include critical information for racial discrimination studies. These amendments required lenders to report both denied and originated loan applications, the race and gender of applicants, and the type of loan purchasers. In addition, the FIRREA amended the HMDA to require the reporting of loan information by independent non-depository lenders with offices in metropolitan statistical areas (MSAs) and with assets exceeding $10 million. In 1991 and 1992, changes in federal regulations expanded the requirement for reporting loan data under the HMDA to include non-depository institutions that made at least 100 home purchase or refinance loans per year, regardless of the institution's asset size. As a result, HMDA data began to include loan data from both large and small mortgage companies after 1993. The expanded HMDA data helped public officials, community advocates, and researchers to analyze racial disparity and discrimination (in combination with other data sources) in mortgage markets and to increase pressure on lenders' behavior regarding racial discrimination.

Changes in the secondary mortgage market also facilitated mortgage lending to low- and moderate-income borrowers and low- and moderate-income minority communities. In 1992, the Federal Housing Enterprises Financial Safety and Soundness Act (FHEFSSA) required government-sponsored enterprises (GSEs), namely Fannie Mae and Freddie Mac, to increase their purchases of mortgages originated on properties in

underserved neighborhoods and further mandated that the U.S. Department of Housing and Urban Development (HUD) set affordable housing goals. HUD is responsible for setting the GSEs' mortgage purchasing goals for homes of low- and moderate-income households; homes located in central cities, rural regions and other underserved areas; and special affordable housing (Freeman, Galster, & Malega, 2006).

Enforcement of the Fair Housing Act (FaHA) and the Equal Credit Opportunity Act (ECOA) also strengthened in the 1990s. The FaHA "prohibits discrimination in home mortgage loans, home improvement loans, and other residential credit transactions, on the basis of color, religion, national origin, sex, familial status or disability," and the ECOA "prohibits creditors from discriminating against credit applicants on the basis of race, color, religion, national origin, sex, marital status, age, or because an applicant receives income from a public assistance program or exercises rights protected under the Consumer Credit Protection Act (United States Department of Justice, 2009)." In 1988, amendments to the FaHA eased the time commitment and monetary burden of plaintiffs seeking redress for violations of the lending laws (Massey & Denton, 1993). Under both the FaHA and the ECOA, the U.S. Attorney General is allowed to prosecute cases on behalf of individuals seeking monetary damage and injunctive relief, and HUD is empowered to initiate fair housing investigations (Immergluck, 2004; Massey & Denton, 1993). In the 1990s, the number of fair lending lawsuits filed by the Justice Department reached historically high levels (Immergluck, 2004).

Table 1 Major Regulatory Changes Influencing Mortgage Markets in the 1990s

Year	Legislation	Major Regulatory Change
1988	Fair Housing Act (FaHA) Amendments	Penalties for defendants increased, the litigation time shortened, and HUD was empowered to initiate fair housing investigation and complaints.
1989	Financial Institutions Reforms Recovery and Enforcement Act (FIRREA)	CRA reports and ratings of the evaluation became publicly available.
		HMDA data included information on denied applications, the race and gender of applicants, and the type of loan purchasers.
		HMDA data included loan information from independent, non-depository lenders with offices in metropolitan statistical areas and assets of more than ten million dollars.
1991	Federal Deposit Insurance Corporation Improvement Act (FDICIA)	HMDA data included loan information from independent, non-depository lenders who made at least 100 home purchase or refinance loans per year regardless of asset size.
1992	Federal Housing Enterprises Financial Safety and Soundness Act (FHEFSSA)	Fannie Mae and Freddie Mac increased their share of the purchase of mortgages originated on properties in underserved neighborhoods and mandated that HUD set affordable housing goals.
1995	Community Reinvestment Act (CRA) Amendments	CRA examination scores more weight on the evaluation of lending outcomes than on the investment and services.

While the private lending industry attempted to adjust its behavior to conform with these legislative and regulatory changes, a new segment of the industry began to rapidly emerge. Subprime loans in the 1990s primarily attracted borrowers with blemished or limited credit histories, carried higher rates of interest, and often involved less favorable loan terms, such as higher fees (United States Department of Housing and Urban Development, 2009). During the mid- and late 1990s, subprime loans increased rapidly from $40 million in 1994 to $160 billion in 1999 (United States Department of Housing and Urban Development, 2002). Between 1993 and 1997, subprime home purchase lending increased 452 percent (Scheessele, 1999), although about 80 percent of such loans were refinance loans, primarily for "cash-out" purposes (Temkin, Johnson, & Levy, 2002). Subprime loans have been faulted for their association with predatory practices and aggressive marketing strategies. Predatory practices occur in all stages of the loan cycle from pre-loan marketing to the post-closing process and include aggressive

push marketing, falsification of borrowers' incomes, inflation of appraised values, exorbitant fees and closing costs, heavy prepayment penalties with higher-interest rates, changes in loan terms at time of closing (bait-and-switch tactics), and additional profit-taking through loan flipping (Renuart, 2004). Since individuals with financial difficulties and a poor understanding of mortgage products comprised the target market for these loans, properties in low-income, minority neighborhoods made up a disproportionate share of the subprime market (Immergluck, 2004).

In the 1990s, the strong economy and moderate interest rates combined with legislative and regulatory changes generated a significant increase in loans to low-income and minority households (Scheessele, 1999). Although these changes neither specifically mention residential racial segregation nor provide direct tools for integrated home buying, they put pressure on lenders to do their business in a non-discriminatory way. And minority homebuyers with better access to mortgages may have gained the ability to buy homes in better neighborhoods, even predominantly white or less-segregated neighborhoods. Several studies have described these increases and analyzed them according to racial/income groups and neighborhoods in an attempt to measure the effects of specific policies. A review of these studies provides an overview of the resulting home buying patterns in terms of racial segregation.

Patterns of Segregated Home Buying in the 1990s

Enhanced HMDA data beginning in the 1990s has allowed housing scholars to examine racially segregated home buying patterns. These studies include three distinct groups: descriptive studies of the segregated patterns of home purchase loans; studies on

the market share of specific loan types in minority mortgage markets and minority neighborhoods; and studies of the impact of specific loan types on racial segregation (see Table 2). This section summarizes the results of the reviewed literature, focusing on the improvement of segregation levels, minorities' disproportionate market share of non-conventional loans, and the impact of different loan types on racial and ethnic segregation.

Changes in Segregated Patterns of Home Buying

Although the limited nature of these studies and difficulties in comparison prevent the drawing of definitive conclusions, home buying segregation appears to have changed slightly during the 1990s. The patterns differ by racial/ethnic groups and vary substantially in different metropolitan areas. One study of the 50 largest metropolitan areas shows lower levels of home buying segregation in 40 metro areas, but higher levels in 10 metro areas (Duda, 2005). The average magnitude of change was somewhat small, 2.4 points based on the dissimilarity index, but in several metro areas it was over 10 points. That study compares segregation of the whole population in 2000 with that of homebuyers in 1999-2001, while other studies compare segregation of homebuyers over time. The study assumes that segregation levels of the entire population in 2000 reflect old segregation patterns and that of homebuyers in 1999-2001 reflects new segregation patterns. An assumption that the segregation of rental housing is lower than that of owner-occupied housing, however, may underestimate the desegregation of homebuyers. Moreover, this study used a multi-ethnic index, which measured the level of segregation among four racial/ethnic groups, making it difficult to directly compare the result with those of other studies that use two-group indices.

Table 2 Studies on Home Buying Segregation in the 1990s

Focus of Study	Author(s)	Year	Study Area	Study Period	Loan Types	Major Findings
Pattern of segregation	MacDonald	1998	St. Louis	1990/92 v. 1992/94	No distinction	More integrative home buying between whites and blacks
	Immergluck	1998	Chicago	1990/91 v. 1995/96	No distinction	Similar level of segregation between whites and blacks
	Stuart	1998	Boston	1990 v. 1993-1998	No distinction	More integrative home buying between whites and blacks and more segregated one between whites and Hispanics and whites and Asians
	Duda and Belsky	2001	9 MSAs	1993-1999	No distinction	Still segregated home buying (no comparison over time)
	Duda	2005	50 MSAs	2000	No distinction	More integrative home buying than population as a whole in terms of multi-group segregation
Disproportionate distribution of loan products in racial/ethnic groups	Pennington-Cross	2002	306 MSAs	1995-1996	Subprime	Proportion of subprime loans is positively associated with proportion of blacks and level of segregation in an MSA.
	Calem, Gillen, and Wachter	2004	Chicago and Philadelphia	1999	Subprime	Proportion of subprime loans is positively associated with proportion of blacks in a neighborhood. Black borrowers have higher likelihood of obtaining subprime loans.
	Calem, Hereshaff, and Wachter	2004	7 MSAs	1997 & 2002	Subprime refinance	Proportion of subprime loans is positively associated with proportion of blacks in a neighborhood. Black borrowers have higher likelihood of obtaining subprime loans.
	Williams, Nesiba, and McConnell	2005	Entire US	1993-2000	Subprime, Manufactured home, & traditional	Large proportion of increase in loans to black borrowers and minority neighborhoods is achieved by subprime and manufactured home loans.
	Williams, McConnell, and Nesiba	1999	Indiana MSAs	1992-1996	CRA-regulated, mortgage companies, subprime etc.	Loans to minority neighborhoods are better served by independent mortgage companies. Market share of CRA-regulated lenders decreased, while subprime share increased.
	Apgar and Duda	2003	Entire US	1993-2000	CRA-regulated	CRA-regulated lenders better serve minority borrowers than other lenders in prime market.
Impact of loan products on segregation	Bond and Williams	2007	237 MSAs	1992-2000	Subprime, government-insured, Manufactured home, & traditional	Increase in loans made by traditional lenders to blacks is positively associated with decrease in segregation level in an MSA.
	Friedman and Squires	2008	101 MSAs	2000	CRA-regulated	Proportion of CRA-regulated loans is positively associated with the proportion of minorities in white neighborhoods.

Case studies of individual cities show mixed results. In Boston, the black-white dissimilarity index fell, but both Hispanic-white and Asian-white indices rose (Stuart, 2000). In Chicago, the distribution of black homebuyers across neighborhoods classified by relative threshold or racial composition and by the Gini index measure showed no change (Immergluck, 1998). One more factor complicating the comparison of results is the change in HMDA data coverage over time. Two studies (Immergluck, 1998; MacDonald, 1998) compared pre- and post-1993 data as well as 1992 and 1993 data. As noted above, the 1992 data included large independent mortgage companies and expanded to cover smaller companies after 1993, and these two studies may have revealed differences between depository institutions and independent mortgage companies. Differences in racial/ethnic groups, metropolitan areas, and lender types make the comparison of single-city case studies difficult.

Patterns identified in individual case studies vary. The segregated patterns described by the absolute measures used in the studies above must be approached with caution. In Chicago, the absolute distribution of black homebuyers across neighborhoods changed toward black neighborhoods, but the relative distribution did not (Immergluck, 1998). The relatively similar distribution of black homebuyers was confirmed in the Gini index, another comparative measure. In Boston, the concentration of black homebuyers in black neighborhoods classified by comparative thresholds decreased, but that of Hispanics and Asians increased (Stuart, 2000). In a slightly different vein, MacDonald (1998) found that home purchase loan applications of both whites and blacks increased in the majority of census tracts in the St. Louis metropolitan area. In sum, black-white segregation in three different metropolitan areas shows mixed results: both more

segregation and more integration. Hispanic-white and Asian-white segregation each became worse in Boston, and segregation among all four groups declined in 40 large metropolitan areas with substantial minority populations.

One study (Stuart, 2000) calculated the dissimilarity indices of home buying according to different income levels to isolate racial impacts across varying levels of income. In this study of the Boston area, the indices generally fell as income levels of minorities rose between 1993 and 1998. In another study of St. Louis (MacDonald, 1998), however, more integrated patterns of home buying were observed in the 1990-1994 period when income gaps increased between blacks and whites. These two case studies provide no clear conclusion regarding the influence of income on segregation. Further, the causes of segregation can vary, including racial differences in socioeconomic characteristics affecting neighborhood choices, racial prejudice of homebuyers, and racial discrimination in housing markets (Dawkins, 2004). Although a complete discussion of the causes behind segregation is beyond the scope of this dissertation, the various determinants of racial segregation should be recognized. In the broader segregation literature, income differences certainly account for some proportion of racial segregation, but they do not explain a significant proportion of black-white segregation (Bayer, McMillan, & Rueben, 2004; Farley & Frey, 1994; Krivo & Kaufman, 1999).

Some studies focused on the increase in minority suburbanization and found that the pattern of segregation was replicated in the suburbs. In Boston, the proportion of black, Hispanic, and Asian suburban buyers increased during the 1990s, where the market shares of those groups also increased (Stuart, 2000). The majority of Hispanics and Asians bought homes in suburban communities, but a slight majority of blacks still

bought homes in the central city. In a national study of low-income minorities, 53 percent of low-income minority homebuyers bought homes in the suburbs (Duda & Belsky, 2001). After identifying increases in minority suburbanization, researchers examined the segregation pattern of suburban home buying. In a Boston study, a comparison of the dissimilarity indices found the segregation pattern in suburbs, as all minority group indices in the suburbs, increased (Stuart, 2000). In the case of Hispanics, even the index in the central city increased substantially. A nine-MSA study revealed that the majority of minority home buying in mostly minority tracts occurred more than eight miles outside the central city (Duda & Belsky, 2001). A 50-MSA study found that the levels of segregation in the suburbs were lower than those in the central cities, but the levels of segregation of suburban homebuyers nearly matched those of the suburban population in 2000 (Duda, 2005). Thus, in Boston, the level of suburban segregation increased while 50 other metropolitan areas showed little change. Given the limited evidence involved and the incompatibility among these studies, one can only conclude that the suburban segregation of homebuyers did not improve substantially during the 1990s. More research is needed to determine if any trend toward suburban home buying segregation is the result of minorities moving into suburban neighborhoods. If so, future studies should focus on the causes and remedies of such a trend.

The relatively small changes in segregated home buying patterns, despite regulatory changes in favor of low-income, minority borrowers and neighborhoods, might be attributed to the fact that the most heavily regulated lenders were less dominant in minority borrowers and neighborhoods. These lenders are depository institutions, which are regulated under the CRA and fair lending laws and which are influenced by the

GSEs' affordable housing goals. Assuming that government-insured loans and subprime loans, both primarily issued by non-depository institutions, were disproportionately distributed to minority borrowers and in minority neighborhoods, the reduced prospect of minority borrowers moving into less-segregated neighborhoods may be explained by the less favorable pricing terms of such loans. Government-insured and subprime loans have less advantageous terms, such as higher insurance premiums and interest rates, especially when compared to conventional prime loans (Williams, McConnell, & Nesiba, 2001).

Racial Differences in Market Shares by Mortgage Products

These varying types of mortgage products are distributed disproportionately among different racial and ethnic groups. For example, while whites receive a higher share of conventional prime loans, black borrowers are more likely to receive government-insured and conventional subprime loans. Analysis of HMDA data from 1992 and 1999 demonstrates that 78 percent of white home buyers obtained conventional loans while 22 percent obtained government-insured loans, compared to 49 percent and 51 percent, respectively, of black home buyers (Bond & Williams, 2007). The same study also shows that for those home buyers receiving conventional loans, six percent of blacks borrowed from subprime lenders compared to two percent of whites. Another study found that although home purchase loans made to minority borrowers increased during the 1990s, more than 40 percent of these gains occurred with subprime and manufactured home lenders (Williams, Nesiba, & McConnell, 2005).

The uneven distribution of government-insured and subprime loans can be attributed to the borrowers' economic and financial constraints as well as their race and

ethnicity. Moreover, segregation itself affects the distribution of loan types across racial/ethnic lines. Pennington-Cross and Nichols (2000), controlling for loan-to-value ratio, payment-to-income ratio, and credit history, found that Hispanics were more likely to receive Federal Housing Administration (FHA) than conventional loans, while blacks were less likely to receive FHA loans. Instead, black borrowers were more likely to get subprime loans. Calem, Gillen, and Wachter (2004), controlling for neighborhood credit risk, income, foreclosure rate, housing turnover rate, and other demographic factors, found that the proportion of blacks in a neighborhood, but not that of Hispanics or Asians, was strongly and positively associated with the subprime share of the neighborhood's loans. The study also found that black borrowers were more likely to obtain subprime loans. Further evidence supports these findings. Pennington-Cross (2002), controlling for economic risks such as housing price appreciation, unemployment rate change, housing cost, and region, found that among low-income borrowers, borrowers in an MSA with a larger proportion of minorities were more likely to use both FHA and subprime loans. He also found that the level of black-white segregation in a metropolitan area positively correlates with the subprime market share in that area. Although this study involved only low-income borrowers, the other two studies applied to minority borrowers of all income levels. Thus, even considering the economic disparity between whites and minorities, minorities are more likely to receive government-insured and subprime loans. The patterns vary, however, between of black and Hispanic borrowers. While Hispanics are more likely to receive government-insured loans, blacks are more likely to obtain subprime loans. Therefore, metropolitan areas with higher levels of black segregation,

not just those with a larger black population, reflect higher shares of subprime loans, raising questions regarding the causes for the black population's reliance on these loans.

Williams, Nesiba, and McConnell (2001; 2005) suggest several reasons for the disproportionate minority market share of subprime lenders. They argue that these lenders targeted minority neighborhoods, where loan originations to black borrowers and minority neighborhoods increased substantially by 2000 at every income level (Williams, et al., 2005). Finding that mortgage companies had larger market shares in Indiana's black mortgage market during the 1990s, Williams et al. (2001) argue that blacks developed only weak relationships with depository institutions in their area, and thus they may have felt alienated from these banks and thrifts and less motivated to choose such institutions than whites were. They also assert that because mortgage companies made a large proportion of government-insured loans and these loans were disproportionately popular among blacks, the mortgage companies consequently made strong inroads into black mortgage markets. Because mortgage companies are responsible for making most of the subprime loans, the preponderance of such loans in the black community may be attributed to the same factors.

Although government-insured and subprime loans are more dominant in the minority mortgage market than in the white market, conventional loans still serve about half of minority borrowers. In 2000, the proportion of conventional purchase loans made by banks and thrifts was at least 50 percent, with substantial cross-MSA variation (Friedman & Squires, 2005). Since the CRA governs banks and thrifts, these institutions are expected to serve low-income neighborhoods and borrowers better than non-regulated institutions. One study confirmed this effect by comparing the performance of loans by

CRA-regulated lenders in their assessment areas, CRA-lenders outside their assessment area, and non-regulated lenders in the prime conventional market (Litan, Retsinas, Belsky, & Haag, 2000). Because minorities historically have earned disproportionately lower incomes, the loans made by these lenders might better serve minority communities. This notion is supported by Apgar and Duda (2003), who found that in the low-income mortgage market, the share of conventional prime loans to blacks and Hispanics made by CRA-regulated lenders within their assessment areas were higher than that of CRA-regulated lenders outside their assessment areas and that of non-regulated lenders.

In sum, minority groups obtained a disproportionate share of government-insured and subprime loans, due not only to the economic and financial constraints of such groups but also due to their minority status. Government-insured loans historically have been concentrated among minority borrowers and in minority neighborhoods and have been provided primarily by mortgage companies rather than depository institutions. The historical alienation of minorities from banks and thrifts also contributed to the emergence of subprime lenders that targeted minority neighborhoods with aggressive marketing strategies. While non-depository lenders increased their share of the minority market by offering subprime loans and government-insured loans, depository institutions also played a role in serving minorities in the prime mortgage markets although these institutions might have had a different effect on racial segregation in home buying. If minority homebuyers who qualified for prime conventional loans at depository institutions chose not to pursue such loans because they found access to non-depository lenders easier and more comfortable, the opportunity for minorities to buy homes in

better neighborhoods might not have shown significant improvement. Thus, the levels of segregation in home buying might vary according to loan product and type of lender.

Different Effects on Segregation by Mortgage Products

The differential distribution of mortgage products among racial/ethnic groups has also affected racial segregation. Two studies examined the effects of different mortgage products on racial segregation. Bond and Williams (2007) tested these effects using HMDA data for 237 metropolitan areas. Controlling for various metropolitan characteristics -- such as the ratio of black-to-white income, regional variances, recent housing construction, population size and growth, the difference in growth rates between black and white populations and between blacks and other minorities, and the difference in the exposure indices between blacks and whites -- the researchers found that the proportion of loans made by traditional lenders (including lenders of government-insured loans, but not subprime or manufactured home lenders) and the increase in the number of loans made by such lenders to black borrowers in a particular metropolitan area were negatively associated with the level of black-white segregation in the area. In contrast, the proportion of loans made by manufactured home lenders in a metropolitan area was positively associated with the level of black-white segregation in the same area. The proportion of government-insured and subprime loans and the increase in the number of such loans made to blacks showed no statistically significant effect on the segregation index. Although the relative impact of loans from traditional lenders on segregation may appear small, it actually affects a large number of borrowers. A ten percentage-point increase in loans made by traditional lenders in a metropolitan area decreased the dissimilarity index by 0.011 points, and a ten percent increase in the number of loans to

blacks made by traditional lenders from 1992-1994 and from 1997-1999 decreased the index by 0.003 points.

Friedman and Squires (2005) examined the impact of loans made by CRA-covered lenders on minority homebuyers' access to white neighborhoods by using HMDA and census data in 2000 for 101 MSAs. Controlling for the mean income of blacks, the proportion of owner-occupied housing units, the vacancy rate of homes, the size of the population, the proportion of the black population, and the black-white dissimilarity index, they found that a ten percentage-point increase in CRA coverage results in a two percentage-point increase in the share of black homebuyers in predominantly white neighborhoods. The impact for Hispanics was more than twice that for blacks.

Controlling for other determinants of racial segregation is essential in determining the impact of mortgage products on the issue. Bond and Williams (2007) and Friedman and Squires (2005) controlled various factors affecting segregation or minority's residential mobility in their metropolitan-level multivariate regression analyses. These factors include various socioeconomic and demographic characteristics and housing market conditions found primarily in decennial census and HMDA data sets. Ideally, the analysis would control for factors affecting both the mortgage product choice and racial segregation to satisfy the need for exogenous mortgage variables. Omitting mortgage characteristics such as credit history and loan-to-value ratio could create biases in estimating the effect on segregation of various kinds of mortgages. Some studies (Calem, et al., 2004; Pennington-Cross & Nichols, 2000) on the relationship between mortgage

products and race and ethnicity controlled for these mortgage characteristics, utilizing data sets from private vendors.

Combining the findings reviewed in this section, it appears that in the 1990s, home buying by minority groups increased relative to that of whites, and the increase occurred in a slightly less segregated way than that of the previous pattern, although with some variation by race and place. One reason for this trend may be that loans with more effect on desegregation drew a smaller share of the minority market than of the white market. Accordingly, an increase in loans made by traditional lenders, especially depository institutions, could contribute to a more integrated pattern of home buying. Unfortunately, in the 2000s, the minority market share of depository institutions decreased, and the number of subprime loans from non-depository institutions increased (Apgar & Duda, 2003).

Changes in Mortgage Markets in the 2000s

In the 2000s, the mortgage market changed primarily due to the innovation in the mortgage industry rather than changes in regulations. The rapid growth of subprime loans began in the 1990s, but the boom in subprime and high-leverage lending in the 2000s differed from the changes in the 1990s. Cash-out refinanced loans with moderate collateral risk drove the 1990s boom, and the market share and growth rate of subprime home purchase loans were substantially lower and slower than in the 2000s (Immergluck, 2009). After a brief plateau due to the Asian and Russian financial crises and the recession of the early 2000s, the second boom of subprime mortgages began. In contrast to the 1990s, the subprime boom in the 2000s was driven by a rapid increase in both

home purchase and refinance loans, especially after 2003. Additionally, exotic features found in many subprime home purchase loans attracted new borrowers.

Subprime loans are often characterized as high-cost or high-priced loans, which include high interest rates and fees (Chomsisengphet & Pennington-Cross, 2006; Lax, Manti, Raca, & Zorn, 2004). The loans are priced high, in part, because of their elevated risk levels. In the literature, researchers often identify the criteria used to classify subprime loans, such as pricing information in the HMDA data, a list of subprime lenders developed by HUD, or whether the loans were sold and packaged in a subprime mortgage-backed securitization.

Subprime mortgages typically exhibit various features that, especially in combination, can increase repayment risks. These include not only PTI and LTV ratios but also lower credit scores, low levels of (or no) income or asset documentation, adjustable or hybrid interest rate structures, prepayment penalties, and other risk-inducing features. Prime conventional loans typically involve borrowers with credit scores above 640 (on a scale to 850), PTI ratios of not more than 28 percent, and LTV ratios of not more than 80 percent, or not more than 95 percent if the borrower has private mortgage insurance. In contrast, subprime loans usually have a variety of risk-inducing features layered on top of one another, which interact and compound default risks. A "middle ground" of moderate-risk, prime or near-prime loans also exists, which, for example, fail to meet only one or two of the usual prime-loan requirements and involve only modest violations of the traditional loan requirements (e.g., PTI ratios of 30 percent or LTV ratios of less than 85 to 90 percent). Credit scores for subprime loans are, on average, lower than those for prime loans (Lax, et al., 2004). The credit scores of subprime loan

borrowers have increased over time, however, narrowing the gap between prime and subprime loan rates (Chomsisengphet & Pennington-Cross, 2006; Foote, et al., 2008).

Two key characteristics of subprime loans became more common in the 2000s: higher PTI and LTV ratios (Chomsisengphet & Pennington-Cross, 2006; Foote, et al., 2008). While the subprime loans in the 1990s and early 2000s were primarily for low credit score borrowers, the lenders' underwriting standards tended to limit other risk factors. As the 2000s progressed, however, subprime loans took on higher PTI and LTV ratios. Further, an increase in exotic features, such as low- or no-documentation loans, piggyback (second mortgage) loans, and hybrid adjustable rate mortgage (hybrid-ARM) structures, which can result in a rapid increase in the amount of monthly payments after two or three years, added additional layers of risk to subprime loans. Moreover, the lack of proper documentation for income and asset values can mean that the true PTI and LTV ratios are greater than those used by lenders in their underwriting calculations. Piggyback loans – subordinate home purchase loans that accompany the principal, senior mortgage – contributed to very high cumulative LTV ratios by letting borrowers purchase homes with virtually no equity. And calculating the PTI ratio based on the initial payment of a hybrid-ARM effectively underestimates the ratio. The prevalence of these loan features in the mid-2000s suggests that the loan risks may be higher than that reflected in data with limited variables.

Expected Impacts of High-Leverage Loans on Neighborhood Location

The features of high-leverage loans such as higher LTV and PTI ratios not only may increase the incidence of initial homeownership but may also help borrowers

purchase more expensive homes. Prospective homebuyers face the mortgage qualification criteria of lending institutions and are constrained by income and wealth as to what down payment they can afford. First, these constraining factors can decrease the rate of home ownership. Linneman and Wachter (1989) find that both of these constraints reduce homeownership probability, with a stronger impact for constraints on down payments. Duca and Rosenthal (1994) also find these constraints to have a significant negative effect on homeownership rates, especially for younger and minority families. Moreover, the income and down-payment constraints can decrease owner-occupied housing demand. Zorn (1989) found that 67 percent of the households that moved and purchased a new housing unit bought lower levels of housing services than the maximum flow of housing services obtainable from newly purchased units given the mortgage market constraints. He used such constraints as 20 percent down-payment and 28 percent payment-to-income ratio with a 25-year fixed-rate mortgage, utilizing the nationally representative sample for 1986. In the model of Hendershott, LaFayette, and Haurin (1997), households constrained by wealth but not by income choose the largest LTV ratio possible to purchase housing closest to their unconstrained housing demand or their desired value of housing unit. In the same model, households constrained by income, but not by wealth, choose higher values for their housing units, when they can access looser income qualifications. Although the researchers tested this model in the context of the choice of FHA-insured loans relative to conventional loans, subprime loans in the mortgage boom also have features that reduce both down-payment constraints -- such as higher LTV ratios -- and income qualification constraints -- such as higher PTI ratio, no or less-income verification, and adjustable-rate structure. In addition, Ross and

Yinger (2002) argue that households with these constraints would consume less housing services to increase the probability of mortgage approval. Therefore, the increase in high-leverage loans is likely to increase homeownership rates and may increase the demand for housing services. Because minorities are disproportionately more income- and wealth-constrained, these effects should be greater for minorities.

When housing demand increases and households buy more expensive housing units, buyers might purchase higher-quality housing units, units in higher-quality neighborhoods, or both. If the quality of housing units and the quality of the neighborhoods are complementary goods, households will tend to purchase better housing units in better neighborhoods. If these two qualities are substitute goods, they will favor one of these goods over the other, depending on prices. Recent studies of American Housing Survey (AHS) data found that these factors do represent complementary goods (Ioannides & Zabel, 2008; Zabel, 2004). Additionally, many suburban communities have exclusionary zoning regulations that prevent the entry of lower-valued housing units (Pendall, 2000). Thus, in many metropolitan areas, the more expensive housing units are disproportionately located in higher-income suburban communities. These factors make it likely, therefore, that the more expensive housing units purchased through access to high-leverage loans would be found in better-quality neighborhoods. Moreover, because better neighborhoods are disproportionately white-dominated neighborhoods and since subprime loans – typically high-leverage loans – have been disproportionately used by minorities, these factors could alter the racial/ethnic composition of neighborhoods, ultimately affecting the level of segregation in these metropolitan areas.

Expected Impacts of High-Leverage Loans on Racial Segregation

The dramatic change in mortgage markets during the 2000s, when subprime home purchase loans grew rapidly from 2002 to early 2007, is likely to have influenced homebuyer segregation. In the 1990s, lenders disproportionately granted subprime loans to minorities and concentrated in minority neighborhoods, resulting in the maintenance of a segregated home buying pattern. As discussed above, subprime home purchase loans in the 2000s differed from those in the 1990s in terms of volume, leverage, and risk characteristics, and the market share of subprime home purchase loans in the 2000s significantly outpaced that of the 1990s. Research by Bond and Williams (2007) found that subprime loans had only an insignificant impact on segregation when the market share of such loans was only 2.9 percent of all buyers and 5.8 percent of black buyers. In the 2000s, the share of home purchase subprime loans increased rapidly. For example, the share of such loans among all conventional loans was 11.5 percent in 2004 and 24.6 percent in 2005 (Avery, Brevoort, & Canner, 2006). Moreover, subprime purchase loans in the 1990s differed from those in the 2000s, with the earlier loans primarily serving borrowers with impaired credit and the later loans typically having higher PTI and LTV ratios.

The features of high-leverage loans such as high LTV and PTI ratios can increase homeownership propensity and help borrowers purchase more expensive homes. Prospective homebuyers face the mortgage qualification criteria of lending institutions and are constrained by income and wealth as to what down payment they can afford. Relaxing these constraints for high-leverage loans in the 2000s is likely to have increased

not only homeownership rates—at least in the short term—but also the demand for housing services. Since minorities are disproportionately more income- and wealth-constrained, these effects are expected to be greater for minorities. When housing demand increases and households buy more expensive housing units, households can purchase more housing unit qualities, more neighborhood qualities, or both. When these two qualities are complementary goods, as demonstrated in recent findings (Ioannides & Zabel, 2008; Zabel, 2004), and exclusionary practices are prevalent, the more expensive housing units purchased via high-leverage loans would be found in higher-income, better-quality communities and neighborhoods.

Because lenders made a disproportionate number of subprime loans to blacks and Hispanics, high-leverage home purchase loans might be expected to contribute to desegregation. Although these high-leverage loans ultimately resulted in very high default and foreclosure rates, they may have at least temporarily encouraged more dispersed home-buying patterns among minorities. Moreover, if wider availability and high PTI and LTV ratios allowed a homebuyer access to a wider variety of neighborhoods, then, even if his or her loan ended in foreclosure, this process may have longer term impacts on segregation. The initial access to different neighborhoods may have a more persistent impact on widening the array of prospective neighborhoods that the buyer (perhaps later a renter) is likely to consider in the home search process. In the 2002-2007 mortgage boom, the greatest increases in subprime and exotic home purchase loans were in high-cost metropolitan areas (Immergluck, 2008). Before the foreclosure crisis began in late 2006 and 2007, high-leverage loans may also have affected many

higher-cost submarkets; thus such loans could have enabled access to a wider array of neighborhoods.

At the same time, the unsustainability of many of these loans suggests that the integrative effects might eventually diminish or disappear due to high default and foreclosure rates. In addition, the virtual collapse of the non-agency secondary market and the high default rates caused lenders to tighten their mortgage standards, which could stifle increased demand by minority homebuyers.

Although many policymakers are advocating for more restrictive mortgage standards on the ground of financial market stability, more stringent standards are likely to limit access to mortgage credit for low-income, minority households and may limit their mobility to better neighborhoods, with the resulting effect on segregation levels. If this impact is supported by empirical evidence, policymakers should consider more appropriate mortgage standards, weighing the benefit of increasing minority mobility to better, primarily white neighborhoods -- as well as other benefits of minority homeownership -- against the costs of potentially higher foreclosure rates. Of course, high-leverage loans should be priced at reasonable levels, not contain predatory features, and be regulated and monitored by state and federal regulators.

CHAPTER 3
HIGH-LEVERAGE LOANS AND RACIAL/ETHNIC SEGREGATION

This chapter presents the research questions and hypotheses within the broader conceptual framework. Research methodologies for testing each hypothesis are detailed in Chapters 4 and 5, including results and discussions of the data analyses.

Research Question

Conceptually, racial segregation might best be addressed with explicit integrative policies. However, due to problems of political viability, there are little federal, pro-integrative policies for owner-occupied houses while there are some policies for rental houses and a handful of local, explicitly pro-integrative efforts (Orfield, 2002). Congress strengthened the fair housing laws somewhat in the late 1980s, but little substantial change in enforcement efforts has occurred (Silverman & Patterson, 2011). The only related, governmental policy to have some effect on desegregation was the strengthened enforcement of the CRA in the middle 1990s. However, in the 2000s, additional gains in minority homeownership were due in large part to the prevalence of subprime loans primarily originated from lenders not regulated by the CRA. Although the CRA may have contributed to desegregation, the legislation failed to regulate independent mortgage companies. This regulatory gap enabled subprime lenders, mostly independent mortgage companies, to exploit low-income, minority borrowers (Immergluck, 2009). With broader CRA regulations, the increase in low-income, minority homeownership might have occurred through more regulated channels, resulting in lower foreclosure rates and thus a more sustainable growth trend. The largest growth in minority homeownership

occurred in the least-regulated segments of the mortgage market, which are associated with very high-risk and sometimes predatory lending. If this growth had occurred in a well-regulated market, however, fewer foreclosures may have resulted.

The type of risks associated with subprime mortgages changed in the 2000s. While subprime loans in the 1990s were primarily for credit-impaired borrowers, those in the middle-2000s entailed other risk characteristics. Credit scores for subprime loans actually improved overall after the 1990s, but PTI and LTV ratios increased. Although lenders specializing in subprime loans assumed more risk than other lenders, at least some lenders resisted layering additional risk factors onto those inherent in these loans. For example, some lenders prohibited borrowers with very low credit scores from obtaining high PTI and LTV loans. The subprime lenders in the mid-2000s avoided the most extreme level of risk associated with higher PTI and LTV ratios by requiring higher credit scores.

In this dissertation, the term, "high-leverage" is used to indicate loans with high-PTI and LTV ratios. An increase in high-leverage loans might increase borrowers' housing consumption and allow them to purchase more expensive homes. The prevalence of no-documentation, piggyback, and hybrid-ARM loans in the middle-2000s also may have inflated effective PTI and LTV ratios, which, in turn, may have increased the loans' effect on housing consumption. Of course, the addition of such features to a loan also may increase the foreclosure risk well beyond desirable levels.

Borrowers also may use the increased purchasing power provided by higher leverage to move into higher-quality neighborhoods. If minority borrowers disproportionately obtain high-leverage loans, as occurred with subprime loans in the

2000s, the effect of these loans on neighborhood choice may be greater for minorities than non-Hispanic whites. Since "higher-quality" neighborhoods are disproportionately white neighborhoods, an increase in high-leverage mortgages might mitigate the neighborhood quality gap between minorities and non-Hispanic whites and reduce levels of racial/ethnic segregation.

Although record-high minority homeownership rates were observed in the middle 2000s, no study to date has thoroughly examined the neighborhood distribution of high-leverage home purchase loans for different racial/ethnic groups and the consequent change in racial/ethnic segregation in the 2000s. Accordingly, this dissertation focuses on two research questions: 1) whether high-leverage home purchase loans enabled borrowers to purchase more expensive homes and homes in higher-quality neighborhoods; and 2) whether these loans affected the racial/ethnic segregation of homebuyers at the metropolitan level. Since blacks and Hispanics comprise significant minorities in many metropolitan areas in the 2000s, we examine the questions for three racial/ethnic groups: non-Hispanics whites, blacks, and Hispanics.

Conceptual Model and Hypotheses

In this section, I outline a conceptual model that demonstrates the potential effect of high-leverage loans on the racial segregation of homebuyers and the relationship between this effect and other causal factors affecting segregation. Using Figure 1, I first describe how high-leverage loans might affect the quality of neighborhoods where borrowers purchase homes and then, using Figure 2, describe how high-leverage loans might play a role in the racial segregation of homebuyers in the context of other causal

factors of segregation.

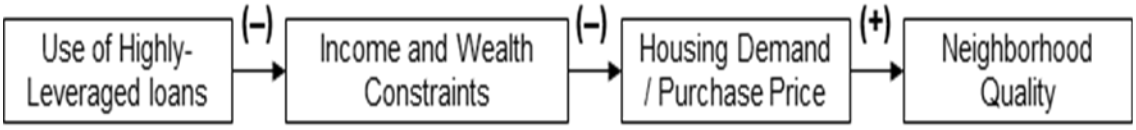

Figure 1. The Effect of High-leverage Loans on Neighborhood Quality

The use of high-leverage loans mitigates the income and wealth constraints of homebuyers as the first arrow indicates. Higher LTV ratios enable households to borrow more given their down payment, and higher PTI ratios allow increased monthly payments due to the elevated default risk in higher LTV loans.

As the second arrow indicates, the lower level of income and wealth constraints enabled by looser underwriting requirements allows borrowers to increase their housing demand and purchase more expensive homes. In the 1980s, approximately 70 percent of mortgage borrowers were constrained by either income or wealth (Hendershott, et al., 1997; Zorn, 1989), and these constrained borrowers had to purchase homes with housing values less than desired (Zorn, 1989). According to the model of Hendershott and his colleagues (1997), borrowers constrained by either income or wealth choose the maximum PTI and LTV ratios to purchase homes with maximum values closer to their desired values, while unconstrained borrowers can purchase homes with their desired housing values and choose optimal PTI and LTV ratios by considering the return on their down-payment investment. In the 2000s, high-leverage loans allowing high PTI and LTV loans provided the opportunity for constrained borrowers to increase their housing demand and purchase homes closer to their desired values. Thus, the first hypothesis is that households who obtain high-leverage loans purchase more housing services than

otherwise equivalent households. Greater housing services can mean larger houses, houses with more convenient features, or houses in higher-quality neighborhoods, which may include neighborhoods with better schools, less crime, better transit options, and various amenities.

The third arrow indicates that when housing demand increases and households buy more expensive homes, they purchase homes in higher quality neighborhoods. However, this result is possible only if the demand for house size and/or house quality and the demand for neighborhood quality are complementary goods. If housing unit size and neighborhood qualities are complements, households will purchase larger housing units in higher-quality neighborhoods, but if these two kinds of housing services are substitute goods, households will choose either of these goods, depending on price. Recent studies of AHS data found that these goods are complements (Ioannides & Zabel, 2008; Zabel, 2004). In addition, many suburban communities have exclusionary zoning regulations that prevent the development of lower-valued housing units within the community, and in many U.S. metropolitan areas, more expensive housing units can be disproportionately found in higher-quality suburban communities (Pendall, 2000). Therefore, it is expected that, on average, more expensive housing units, sometimes purchased via access to high-leverage loans, will be larger homes that tend to be located in higher-quality neighborhoods. The second hypothesis of this dissertation, therefore, is that when households obtain high-leverage loans and all other household characteristics are equal, the neighborhood quality of the purchased home increases.

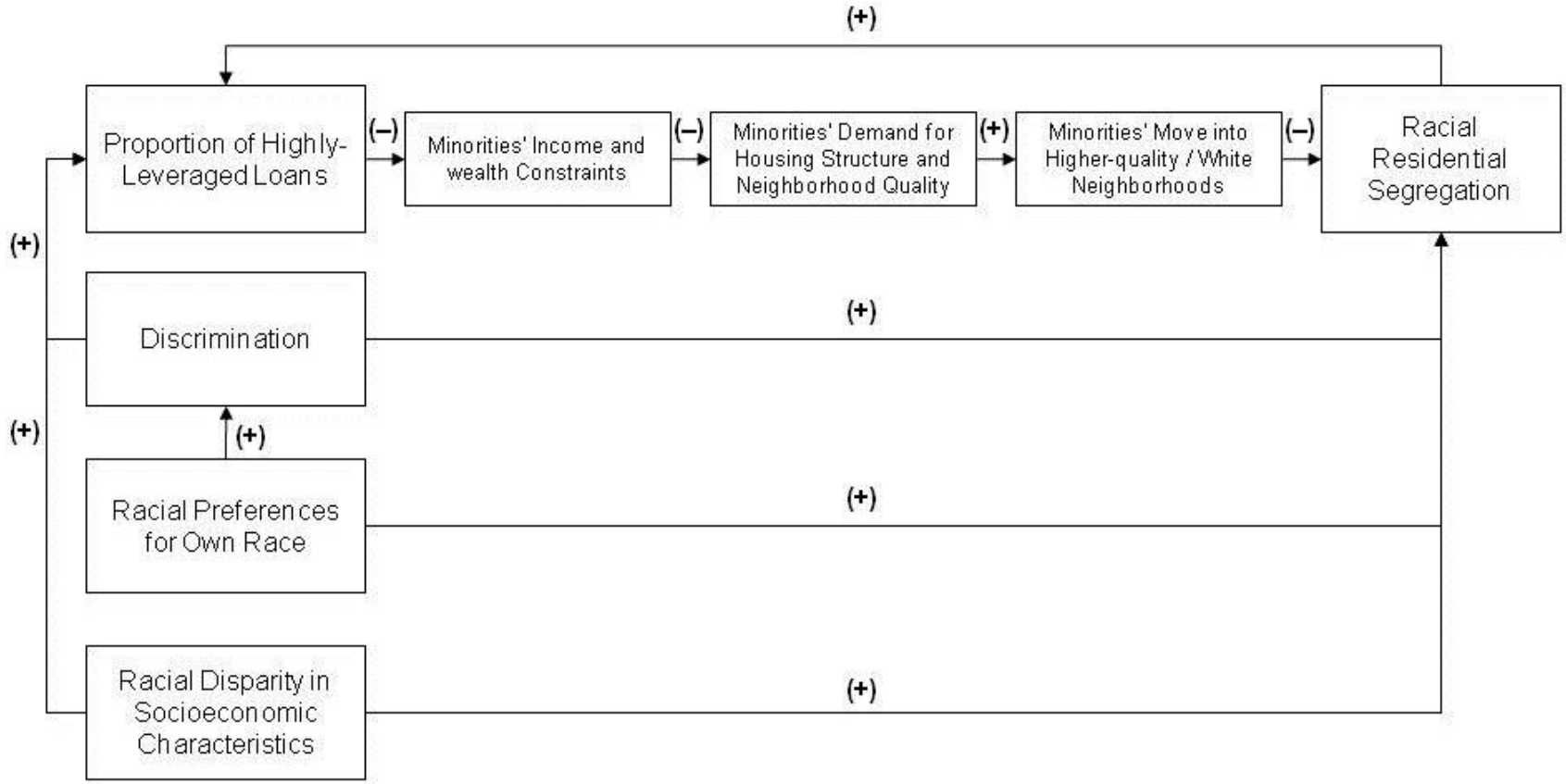

Figure 2 Links among Racial/ethnic Residential Segregation and Causal Factors

The effect of high-leverage loans on borrowers' neighborhood outcomes may be linked to the racial segregation of homebuyers. This mechanism, together with other factors affecting segregation, is shown in the top of Figure 2. The proportion of high-leverage loans in an MSA is expected to decrease income and wealth constraints of minorities relative to those of whites because historically subprime loans, which include many high-leverage loans, have been made to a disproportionate number of minority borrowers (Avery, et al., 2006; Bond & Williams, 2007; Williams, et al., 2005). The disproportionate minority share of subprime loans is caused by both economic/financial constraints and race/ethnicity per se. Some studies find differences in the probabilities of obtaining subprime loans across racial and ethnic groups, even after controlling for economic variables (Pennington-Cross, 2002; Pennington-Cross & Nichols, 2000). Williams and his colleagues (2005) argue that subprime lenders target minority neighborhoods and aggressively market their products and that this marketing can work because of the historical alienation between minorities and traditional depository lending institutions. Since no evidence has emerged of narrowing economic gaps between minorities and non-Hispanic whites and since few significant social or regulatory changes improved the relationship between minority borrowers and lending institutions, the disproportionate minority share in subprime loans, including high-leverage loans, continued in the 2000s. Thus, more minority borrowers became able to mitigate their income and wealth constraints through increased access to high-leverage loans relative to white borrowers. Further, the proposition that more minority borrowers could mitigate their income- and wealth-constraints implies an increase in housing demand and home purchase price of minorities. As minority housing demand increases, the quality of

neighborhoods where minority borrowers with high-leverage loans can purchase homes may also be expected to increase, due to the complementary nature of the demand for housing structure and neighborhood quality.

Next, the increase in neighborhood quality of minority, high-leverage borrowers and neighborhood segregation can be linked by the disproportionate distribution of higher neighborhood quality in predominantly- or majority-white neighborhoods. Historically, higher-quality neighborhoods have been disproportionately white due, in part, to the combination of the lower incomes earned by minorities and whites' resistance to racially-mixed neighborhoods. Several researchers have emphasized inequality in neighborhood outcomes across racial composition, poverty status, or inner-city/suburb divide (Dreier, Mollenkopf, & Swanstrom, 2001; Massey & Denton, 1993; Wilson, 1987). The common indicators of neighborhood quality in these studies include access to jobs, median income, unemployment rate, poverty rate, housing unit qualities/values, school qualities, crime rates, local public services and shopping convenience. These attributes typically correlated strongly with racial composition. If hypotheses one and two are true, minority borrowers with high-leverage loans should be able to purchase homes in higher-quality neighborhoods. When minority demand for higher-quality neighborhoods increases, minorities can purchase homes either in existing, primarily white neighborhoods or in newly created neighborhoods, which tend to be more racially diverse. Thus, minority borrowers with high-leverage loans are likely to purchase a home in primarily white neighborhoods or in racially diverse neighborhoods. Assuming this correlation between high-quality neighborhoods and neighborhood racial composition, I propose the third hypothesis that homebuyers are less racially segregated in a metropolitan area with a

higher share of high-leverage loans when other metropolitan characteristics are equal.

With regard to this third hypothesis, in Figure 2, considers causal factors other than the proportion of high-leverage loans that affect the racial segregation of homebuyers. Figure 2 outlines a conceptual framework for the relationship among racial segregation, the proportion of high-leverage loans, and other major causal factors of segregation, such as discrimination, racial preference, and racial disparity socioeconomic characteristics. The direction of the arrows and the sign in parentheses indicate the causal relationship among these variables. The major causes of racial/ethnic segregation are frequently divided into at least three categories: 1) in-group preferences (and/or out-group animus) and self-sorting; 2) interracial differences in socioeconomic and demographic characteristics; and 3) discrimination. The preferences of neighborhood racial/ethnic composition, surveyed in several metropolitan areas, show that whites prefer white-majority neighborhoods with a small percentage of minorities, but minorities prefer more integrated neighborhoods or minority-majority neighborhoods with a sizable percentage of whites (Charles, 2001; Clark, 1991; Farley, Fielding, & Krysan, 1997). These preferences for neighborhood racial/ethnic composition cause whites to move to predominantly white neighborhoods and to avoid neighborhoods with significant proportions of minority groups. Although the preferences of blacks and Hispanics also affect racial segregation, the effect of these preferences is likely to be minimal (Ihlanfeldt & Scafidi, 2002). Cultural assimilation also influences the racial preferences of minorities. Assimilation theory predicts that immigrants are segregated when they arrive in the country, but as they become culturally and socioeconomically assimilated over time, they tend to scatter among the mainstream neighborhoods. This factor, however, is

more relevant for Hispanics than blacks (Massey & Denton, 1993).

In-group preferences of whites could lead to differential treatment or discrimination against minorities. For example, discrimination by real estate agents and mortgage brokers or lenders can create obstacles to residential mobility. Such discrimination could be direct or referred, such as when realtors steer minority groups away from white neighborhoods for fear of angering or irritating residents (and potential customers) in those neighborhoods. Although explicit discrimination became illegal and was prohibited by the Fair Housing Act of 1968 and its amendments in 1988, enforcement of these laws has been inconsistent, and more subtle forms of discrimination may still persist (Galster, 2008). The U.S. government's discrimination study reports that despite the decrease in overall discrimination, the steering of minority homebuyers to minority neighborhoods increased during the 1990s (Turner, Ross, Galster, & Yinger, 2002).

Interracial differences in socioeconomic and demographic characteristics can also affect segregation patterns. A decreased ability to afford housing costs may result in minorities residing in neighborhoods with lower property values or more rental units. Blacks and Hispanics are relatively limited in income and wealth when compared to whites, affecting their ability to meet their desire for housing, including housing in higher-quality neighborhoods. Household characteristics such as age of the householder, existence of children, and marital status are also likely to affect the choice of neighborhood (Rossi, 1955). Accordingly, interracial differences in household characteristics may cause different preferences for housing and neighborhoods.

Other causal factors such as discrimination and racial disparity in socioeconomic

characteristics also affect the proportion of high-leverage loans. If these factors are properly controlled, the effect of high-leverage loan on racial segregation will not be biased. While racial disparity in socioeconomic characteristics can be measured without severe measurement error, discrimination is difficult to measure. Due to this lack of data, the presence and degree of discrimination can be measured only by proxies, such as the age of population and the proportion of minority population. When the measure of discrimination is not accurate, the bias will be positive because discrimination is positively correlated with both the proportion of high-leverage loans and racial/ethnic segregation. Because the expected effect of the proportion of high-leverage loans is negative, our measure of effect can be regarded as a conservative one.

The bidirectional arrow between the proportion of high-leverage loans and racial segregation suggests the potential for simultaneity. Recent research finds empirical evidence for the positive effect of segregation on the proportion of subprime loans (Been, Ellen, & Madar, 2009; Squires, Hyra, & Renner, 2009). When conventional lenders avoid segregated neighborhoods and subprime lenders target these neighborhoods, segregation level is positively associated with the proportion of subprime loans (Hyra, Squires, Renner, & Kirk, 2012; Williams, et al., 2005). To address potential simultaneity, instrumental variables estimation will be used via a two-stage least square regression.

CHAPTER 4
IMPACT OF HIGH-LEVERAGE LOANS ON HOME VALUE AND NEIGHBORHOOD QUALITY

As discussed in Chapter 3, borrowers with low income and wealth may realize their desired housing consumption from the increased purchasing power afforded by higher LTV and PTI ratios, which allow them to buy more expensive homes. Due to the complementary nature of housing unit and neighborhood qualities and the practice of exclusionary land use, borrowers with high-leverage loans are expected to purchase homes in higher quality neighborhoods compared to those with similar household characteristics.

This chapter empirically tests the hypothesis that households who obtain high-leverage loans purchase houses with greater housing services and houses in higher-quality neighborhoods, when other household characteristics are equal, relying on the national version of AHS data.

Methodology

The analysis uses the national version of the AHS microdata from 2001 to 2007, which randomly selects housing units throughout the United States. Since the national AHS data are collected every two years in odd-numbered years, four waves of data, from 2001, 2003, 2005, and 2007, were merged. The AHS data represents the only publicly available household-level microdata with household, housing unit, neighborhood quality, and mortgage characteristics.

Although the total number of observations for owner-occupied housing units in the merged data set is 135,181, the sample size in this analysis is dramatically reduced to 3,006 in the data selection and cleaning process. First, among the available observations, only the observations on housing units purchased within two years from the survey year are included in the sample. For example, in the 2003 data, only units purchased in 2001, 2002, or 2003 are selected. Since household characteristics at the time of interview are recorded in the data, the observations on more recent buyers have more accurate household characteristics at the time of home purchase. To balance the accuracy of household characteristics at the time of home purchase and the number of sample observations, the observations two years prior to the survey year and at the survey year are used. This selection procedure produces some duplicate observations. For example, if a unit is purchased in 2001 before the survey date and the same household stays in the unit until the 2003 survey date, the information on home purchase is recorded both in 2001 survey and 2003 survey. Further, these duplicate observations have identical characteristics on home purchase, but different household characteristics reflecting changes between 2001 and 2003. Thus, in this example, the observation recorded in the later survey, the 2003 survey, must be excluded. If a unit is purchased in 2001, but after the survey date, no duplication of data occurs. Using information indicating whether a household lived in this unit in the previous survey and when a household moved, I eliminated the duplicate observations. These procedures reduced the sample size to 18,307. In addition, the observations on manufactured housing and those missing the MSA indicator are excluded, reducing the sample size to 6,986.

Further, observations with purchase prices below $10,000 are excluded. Also, observations with purchase prices less than or equal to 80 percent of the owner's valuation of the unit are excluded because these observations are not likely to be arm's-length transactions. In addition, observations with topcoded values on purchase price, loan amount, income, and mortgage payment are excluded because it is impossible to calculate accurate LTV and PTI ratios for these observations. Finally, observations with CLTV (combined loan-to-value) ratios greater than 1.3 and those with PTI ratios greater than 0.7 are excluded. CLTV ratios greater than 1 could occur because interviewers reported home purchase prices excluding the closing cost. Also, the purchase price is likely to be smaller than the assessed value in this period of rapid housing price appreciation. The lax underwriting standards of the 2000s, especially by subprime lenders, can partially explain PTI ratios that are higher than the GSE standards. Observations with extreme values in CLTV and PTI ratios are considered as coding errors. Since I cannot access lenders' data, the CLTV and PTI ratio in the sample should be considered as proxies, not the accurate ratios on the lenders' books. However, as described in the descriptive statistics, these proxies show a reasonable representation of the expected trends in CLTV and PTI ratios. The source of metropolitan areas' house price is the Federal Housing Finance Agency (FHFA)'s house price data.

To examine the effects of high PTI and CLTV ratios on housing demand and neighborhood qualities, I use a linear regression for the housing demand model and a binary logit model for the neighborhood quality model. First, to examine the effect on housing demand, the following model is estimated:

$$\ln(H_i) = \beta_0 + \beta_1 PTI_i + \beta_2 CLTV_i + \beta_3 \ln(Price_i) + \beta_4 X_i + \beta_5 MSA_i + \beta_6 t_i + e_i \quad (1).$$

In this model, ln(H_i) is the log of housing demand index of household *i*. Housing demand is not directly observed; rather only the product of quantity and price (or total expenditure) is. Therefore, a housing demand index is calculated by dividing the housing expenditure or a house purchase price by the MSA housing price index, assuming one housing price per an MSA, following Zabel (2004). The housing expenditure is measured by the owners' valuation in the AHS data, and the MSA housing price index is measured by the FHFA house price index for metropolitan area where the household resides. The primary explanatory variables of interest, *PTI* and *CLTV*, are PTI and CLTV ratios of household *i*'s home purchase loan. Ln($Price_i$) is the log of MSA housing price index. The vector X_i is a set of other variables affecting housing demand, such as household characteristics and mortgage characteristics other than PTI and CLTV. These include the log of household income, household size, the household head's age, the interest rate of the loan, a dummy variable indicating a government-insured loan, a dummy variable indicating an adjustable rate mortgage (ARM), down payment, and square of down payment. I use the logged form of the housing price index and household income variables to reduce non-normality and represent their effects as elasticities, as in most housing demand literature.

Also, X_i includes dummy variables indicating married-couples and female-headed families and variables indicating black, Hispanic, Asian, and other races. Omitted categories are male-headed family for family type and non-Hispanic white for race/ethnicity. In addition, a set of MSA dummies, MSA_i, and the year of home purchase,

t_i, is controlled to capture MSA fixed effects other than housing price and yearly trend.

To examine the impact on neighborhood qualities, the following model is estimated:

$$P(y_i = 1|\mathrm{x_i}) = \frac{1}{1 + exp - (\beta' \mathrm{X_i})} \qquad (2).$$

The dependent variable $P(y_i=1)$ is the conditional probability of choosing a better neighborhood. All the binary neighborhood quality indicators are recoded so that one indicates better quality and zero indicates worse quality. Each neighborhood quality variable is described in detail in the descriptive statistics section. A vector X_i includes all the explanatory variables included in model (1).

Results

Table 3 shows descriptive statistics for the full AHS sample. All dollar values are adjusted to 2007 dollars using the U.S. city average, all items less shelter series of Consumer Price Index of the Bureau of Labor Statistics. The average purchase price is $201,796 in 2007 dollars, which is greater than the $164,233 average in the ACS data from 2007. The average family income is $84,885, which is also greater than the average of $80,265 found in the ACS data from 2007. The average household size is 2.78. Married-couple, male-headed, and female-headed families comprise 58, 20, and 22 percent of the sample, respectively. Heads of Household with a high school diploma or some college experience, those with a bachelor degree, and those with a post-graduate degree comprise 50, 28, and 14 percent of the sample, respectively. Household heads without a high school diploma comprise only eight percent of the sample. Non-Hispanic

white, black, Hispanic, and Asians comprise 67, 10, 16, and 6 percent of the sample, respectively.

Table 3 Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Purchase Price	201,795.69	100,774.05	17,800.75	554,731.19
Housing Price Index	180.96	39.12	103.59	352.39
Housing Demand Index	1,103.71	473.59	96.57	3,414.01
Family Income	84,884.91	66,286.30	4,634.98	812,794.62
Household Size	2.78	1.52	1.00	17.00
Married Couple Household	0.58	0.49	0.00	1.00
Male-headed Household	0.20	0.40	0.00	1.00
Female-headed Household	0.22	0.42	0.00	1.00
Age of Householder	38.16	11.18	16.00	88.00
No high school graduate	0.08	0.27	0.00	1.00
High school graduate or more	0.50	0.50	0.00	1.00
Bachelor degree	0.28	0.45	0.00	1.00
Post-graduate degree	0.14	0.35	0.00	1.00
Non-Hispanic White	0.67	0.47	0.00	1.00
Black	0.10	0.30	0.00	1.00
Hispanic	0.16	0.37	0.00	1.00
Asian	0.06	0.23	0.00	1.00
Others	0.01	0.10	0.00	1.00
Loan Amount	167,456.12	88,409.21	1.06	548,211.91
Interest rate	7.40	1.65	1.10	20.49
Term	28.33	5.23	1.00	37.00
Government-insured	0.26	0.44	0.00	1.00
ARM	0.07	0.26	0.00	1.00
Down payment	35,401.65	53,407.49	0.00	405,574.34
CLTV	0.85	0.20	0.00	1.29
PTI	0.23	0.12	0.00	0.69
N	3,006			

Government-insured loans comprise 26 percent of all loans, which suggests that such loans may be somewhat overrepresented in this sample. However, a declining trend occurred in the share of government-insured loans; it decreased from about 35 percent in 1999 to 22 percent in 2007. ARMs comprise seven percent of all loans. Average CLTV and PTI ratios are 0.85 and 0.23 respectively (Table 3). CLTV and PTI ratios increased over time, but the magnitudes of increase are somewhat smaller than expected. Grouping loans based on typical thresholds on PTI and CLTV ratios, however, shows a clearer

picture of changing loan types. Higher-risk loans, in terms of both PTI and CLTV ratios, increased substantially between 1999 and 2007. While the proportion of loans with PTI ratios of less than 0.2 decreased by 9.6 percentage points, the proportion of loans with PTI ratios of greater than 0.3 increased by 9.5 percentage point between 1999 and 2007 (Table 5 and Figures 3 through 6). The proportion of loans with PTI ratios greater than or equal to 0.2, but less than 0.3, was fairly stable over time. The proportion of loans with CLTV ratios greater than or equal to 0.9 and less than 1 decreased by 9.3 percentage points, while the proportion of loans with CLTV ratios greater than or equal to 1 increased by 9.4 percentage points (Table 6 and Figures 7 through 10). Thus, the sample is consistent with previous findings of increasing PTI and CLTV ratios made in the peak of the mortgage boom period. However, the patterns of the loans' PTI and CLTV ratios are slightly different. In the case of PTI ratios, the significant change was a shift from loans with low-PTI ratios to those with high-PTI ratios. In the case of CLTV ratio, the most significant change was the shift from loans with high CLTV ratios to those with even higher CLTV ratios. (This CLTV ratio should be considered as a proxy for the actual CLTV ratio in a lender's book. Lenders are unlikely to make loans with a CLTV greater than 1, but due to the reasons outlined in the data description, this category is likely to capture loans with CLTV ratios very close to 1 in the lender's calculation.) Finally, as expected, the CLTV and PTI ratios are significantly higher for blacks and Hispanics than for non-Hispanic whites and Asians (Table 7). Hispanics' PTI ratios are generally greater than black's PTI ratios, while a similar pattern is not found in the LTV ratios.

Table 4 Means of CLTV and PTI over Time

	CLTV	PTI	N
1999-2000	0.83	0.21	634
2001-2002	0.85	0.23	828
2003-2004	0.86	0.23	840
2005-2007	0.85	0.24	705

Table 5 Proportions of PTI over Time

	PTI < 0.2	0.2 ≤ PTI < 0.3	PTI ≥ 0.3	N
1999-2000	51.9%	30.0%	18.1%	634
2001-2002	46.5%	32.0%	21.5%	828
2003-2004	46.2%	31.4%	22.4%	840
2005-2007	42.3%	30.1%	27.6%	704

Table 6 Proportions of CLTV over Time

	CLTV < 0.8	0.8 ≤ CLTV < 0.9	0.9 ≤ CLTV < 1	CLTV ≥ 1	N
1999-2000	31.5%	14.5%	32.3%	21.6%	634
2001-2002	27.9%	17.6%	31.4%	23.1%	828
2003-2004	27.3%	17.7%	24.6%	30.4%	840
2005-2007	28.7%	17.3%	23.0%	31.0%	704

Table 7 Loan's Risk Characteristics by Race and Ethnicity

	CLTV	PTI	CLTV ≥ 1	PTI ≥ 0.3
Non-Hispanic White	0.84	0.22	22.9%	17.7%
Black	0.89	0.23	43.1%	24.5%
Hispanic	0.89	0.28	37.7%	41.1%
Asian	0.80	0.23	12.9%	20.0%

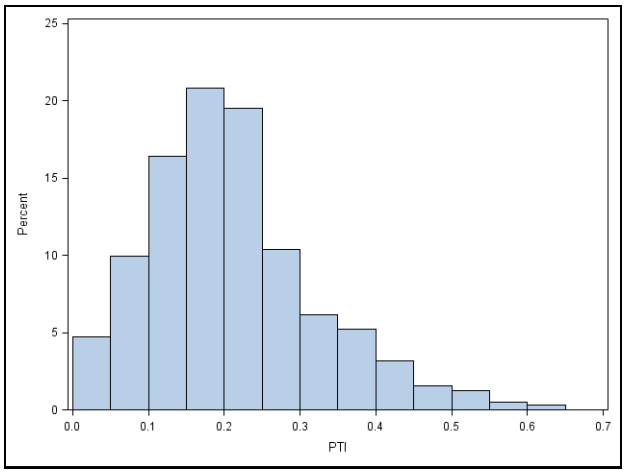

Figure 3 Distribution of PTI during 1999-2000

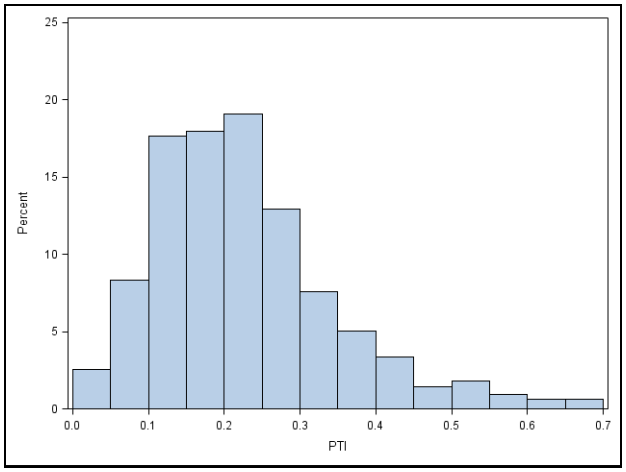

Figure 4 Distribution of PTI during 2001-2002

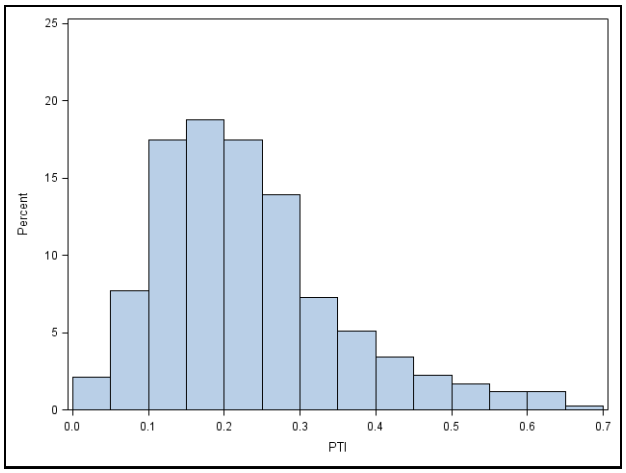

Figure 5 Distribution of PTI during 2003-2004

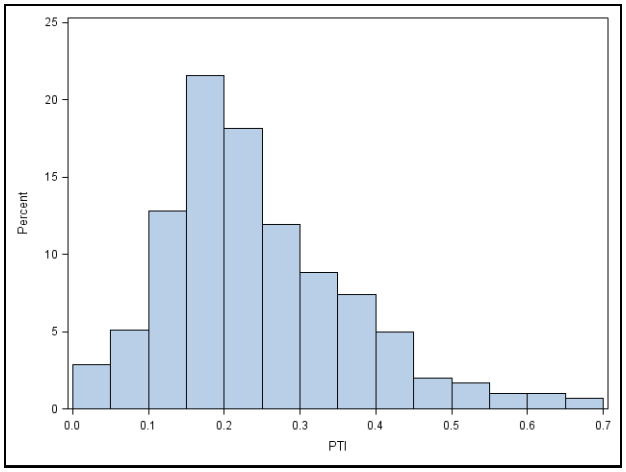

Figure 6 Distribution of PTI during 2005-2007

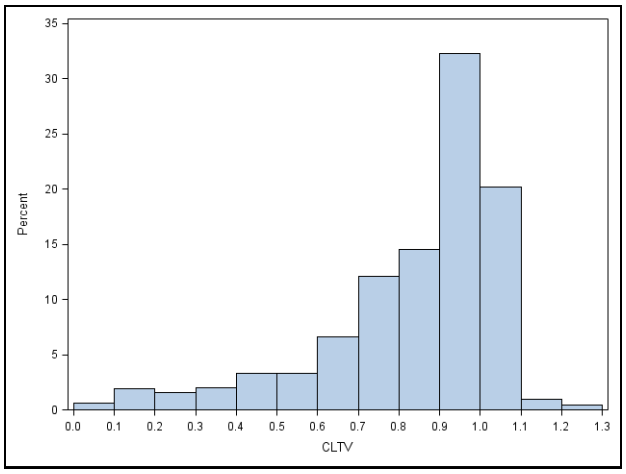

Figure 7 Distribution of CLTV during 1999-2000

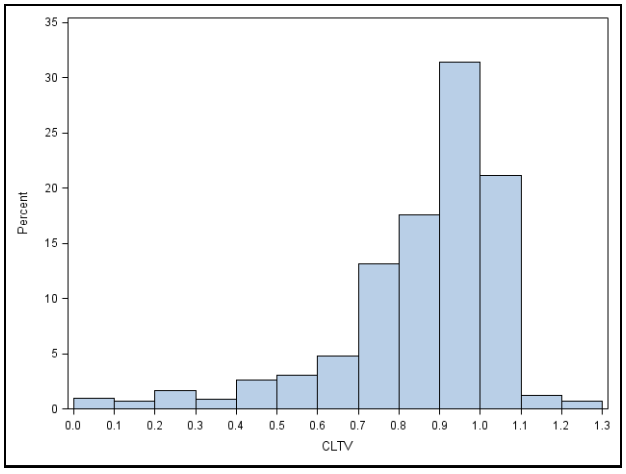

Figure 8 Distribution of CLTV during 2001-2002

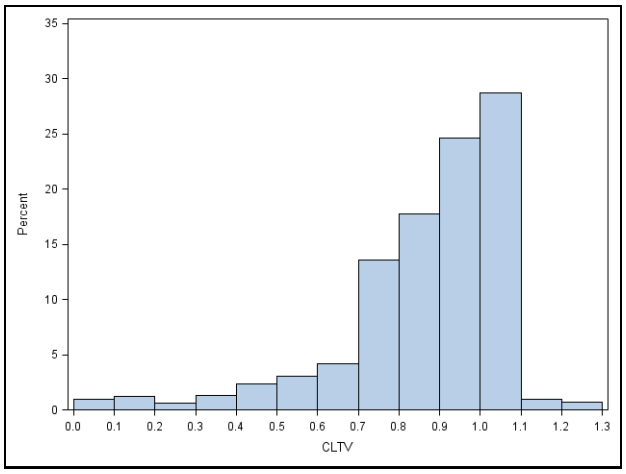

Figure 9 Distribution of CLTV during 2003-2004

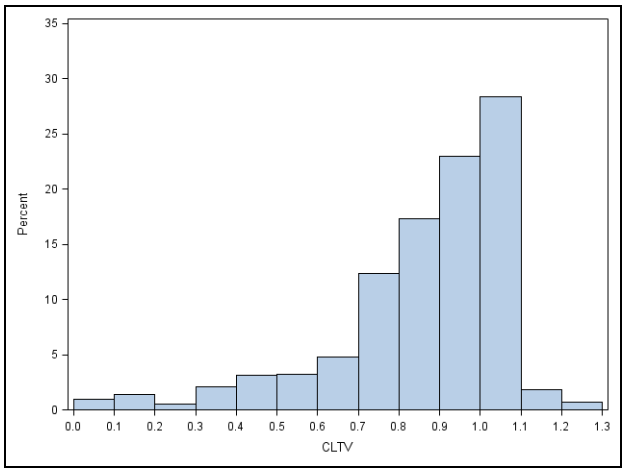

Figure 10 Distribution of CLTV during 2005-2007

The AHS data have variables that measure the condition or quality of neighborhoods. A total of 22 variables exist in the four waves of surveys, and their descriptive statistics are reported in Table 8. All these variables are dummy variables that equal one if what is expected to be a generally desirable characteristic is present in the neighborhood; otherwise they equal zero. For example, the "No Townhouses or Rowhouses" variable equals one if single-family townhouses or rowhouses are not

present within a half block of the house; otherwise it equals zero. The "No Townhouses or Rowhouses", "No Apartment Buildings", "No Mobile Homes", "No Business or Institutions", "No factories or Industrial Structures", "No Parking Lots", and "No Railroad, Airport, or Highway" variables measure whether potentially undesirable land uses are absent in the neighborhoods, while the "Open Spaces" variable measures whether positive or desirable land uses are present. The "No Abandoned Buildings", "No Buildings with Bars on Windows", "No Trash or Junk", and "No Roads Needing Repairs" variables measure the absence of the typical, negative features of declining or blighted neighborhoods. The "High Neighborhood Rating" variable equals one if the overall neighborhood rating is eight, nine, or ten; otherwise it equals zero. The "No Noise", "No Bad Smells", "Satisfactory Police Protection", "Satisfactory Public Elementary School", "Public Elementary School within 1 mile", "Better School Performance", "Satisfactory Neighborhood Shopping", "Neighborhood Stores within 15 minutes", and "No Serious Neighborhood Crime" variables measure neighborhood qualities on noise, smell, police protection, public school, and shopping.

Neighborhood quality variables can be divided into two larger categories: variables evaluated by interviewers and those evaluated by interviewees. The variables from the first row to the 12th row in Table 8 are evaluated by interviewers, while the remaining variables are evaluated by interviewees. Interviewers observe and answer questions describing the immediate surroundings, within a half block of the sample unit, while interviewees answer questions based on their subjective assessment of surroundings that they consider to be their neighborhoods (Econometrica, Inc., 2011). The variables answered by interviewers are expected to measure the neighborhood

quality more objectively than the variables answered by interviewees, because standards of interviewees can vary greatly and might be conflated by race, income, or some other household characteristics. The interviewer-observed variables are answered by observation rather than subjective satisfaction.

Table 8 Descriptive Statistics of Neighborhood Quality Variables

Var. #	Variable	Num. of Obs.	Mean	Std. Dev.
1	No Townhouses or Rowhouses	2964	0.78	0.41
2	No Apartment Buildings	2979	0.78	0.41
3	No Mobile Homes	2980	0.99	0.12
4	No Business or Institutions	2980	0.76	0.43
5	No Factories or Industrial Structures	2980	0.98	0.15
6	No Parking Lots	2980	0.79	0.40
7	No Railroad, Airport, or Highway	2981	0.88	0.32
8	Open Spaces	2978	0.31	0.46
9	No Abandoned Buildings	2971	0.97	0.18
10	No Buildings with Bars on Windows	2890	0.91	0.29
11	No Trash or Junk	2979	0.93	0.25
12	No Roads Needing Repairs	2975	0.67	0.47
13	High Neighborhood Rating	2954	0.70	0.46
14	No Noise	481	0.82	0.39
15	No Bad Smells	3001	0.96	0.19
16	Satisfactory Police Protection	2904	0.95	0.22
17	Satisfactory Public Elementary School	957	0.85	0.36
18	Public Elementary School within 1 Mile	1139	0.71	0.46
19	Better School Performance	201	0.45	0.50
20	Satisfactory Neighborhood Shopping	2977	0.93	0.26
21	Neighborhood Stores within 15 Minutes	2788	0.87	0.34
22	No Serious Neighborhood Crime	2968	0.87	0.34

The observations on neighborhood quality variables are smaller than those on housing demand due to missing responses on these variables. Variables whose sample size is less than 2,000 such as the “No Noise”, “Satisfactory Public Elementary School”, “Public Elementary School within 1 Mile” and “Better School Performance” variables are excluded in the subsequent analysis. The proportion of households living in neighborhoods without “bad” neighborhood characteristics are greater than about 70 percent for most of the neighborhood quality variables. Exceptions are the “Open

Spaces", "No Roads Needing Repairs", and "Better School Performance" variables. In the sample, only 31 percent of the households live in neighborhood with open spaces. The proportion of households living in neighborhoods without roads needing repairs is 67 percent and the proportion of those living in neighborhoods with better than average schools is 45 percent. The proportion of households living in neighborhoods with a "High Neighborhood Rating" is 70 percent. A high rating is defined as a rating greater than eight on a scale of one-to-ten. Since each household rated its own neighborhood, the data reflects that 70 percent of households are highly satisfied with their neighborhoods. Separate tabulations (not shown here) show that only 6.8 percent of households gave a rating of less than five to their neighborhoods. Some of the variables, including "High Neighborhood Rating", are originally measured at ordinal levels but recoded at binary levels. In preliminary analyses, ordered logit models did not work, primarily due to a violation of the proportional odds assumption, so the descriptive statistics are provided for variables recoded as binary ones to be consistent with the following binary logit model estimation results.

The estimation results for equation (1) are reported in Table 9 as Model 1. In this model, PTI ratio and CLTV ratio variables are positively associated with housing demand as hypothesized. Since the positive effect of CLTV ratio is likely to occur for households constrained by down payment, I also estimated the model with the series of CLTV ratio intervals over 0.85. The CLTV ratio variable is replaced by a set of dummy variables of CLTV ratios in Model 2. The CLTV ratio dummy variables equal one if a loan is within the given CLTV interval and equals zero if not. For example, the CLTV_85_90 variable is one if a loan's CLTV ratio is equal or greater than 0.85 and less than 0.95. The

reference category is a CLTV ratio of less than 0.85. The down payment variable is included in the model as a proxy for the wealth variable, which is not available in the AHS data. I assume that the down payment is roughly proportional to the liquid wealth of most households. Accordingly, the coefficient for down payment is interpreted as the effect of a household's liquid wealth. Also, the coefficient for the CLTV variable is interpreted as the effect of the CLTV, holding other variables constant, including the liquid wealth for down payment.

The elasticities of income and housing price are statistically significant at 0.01 and 0.52 and –0.60, respectively in the Model 1, as expected based on neoclassical consumer theory. In the Model 2, the magnitudes of these elasticities are 0.55 and –0.60, respectively. Household characteristics are all statistically significant except dummy variables for female-headed, Asian, and other race households. An increase of one more household member and that of ten years in the age of the head of household are expected to increase housing demand by about one percent, other things being equal, indicating a small impact in magnitude. Married couple households are expected to consume five percent more housing than male-headed households, with other things being equal. The education level of a household head has a greater effect on housing demand than household size and the age of the household head. Where the head of the household has a high school diploma, bachelor's degree, or post-graduate degree, the household is expected to consume 5 to 6, 12 to 13, and 15 or 17 percent more housing respectively. Also, as expected, black and Hispanic households consume less housing than non-Hispanic households by 9 or 3 percent respectively.

Table 9 Results of Housing Demand Regressions

		Model 1			Model 2	
Variable	Coef.	t	p-value	Coef.	t	p-value
Intercept	3.118	12.40	<.0001	3.064	12.04	<.0001
LN_ZINC_07	0.520	45.55	<.0001	0.552	50.96	<.0001
LN_HP_07	-0.601	-13.08	<.0001	-0.586	-12.61	<.0001
PER	0.009	2.63	0.0085	0.009	2.68	0.0074
HHAGE	0.001	3.36	0.0008	0.001	3.31	0.0009
MARRIED	0.046	3.82	0.0001	0.046	3.72	0.0002
FEMALE_HEAD	-0.019	-1.42	0.1558	-0.017	-1.27	0.2036
HIGH	0.055	3.17	0.0015	0.063	3.59	0.0003
BACH	0.117	6.13	<.0001	0.130	6.75	<.0001
PGRAD	0.152	7.30	<.0001	0.166	7.86	<.0001
BLACK	-0.087	-5.75	<.0001	-0.087	-5.66	<.0001
HISPANIC	-0.020	-1.41	0.1582	-0.027	-1.96	0.0499
ASIAN	-0.022	-1.15	0.2515	-0.017	-0.91	0.3651
OTHERS	0.008	0.17	0.8644	0.011	0.26	0.7983
INTEREST_07	-0.035	-10.97	<.0001	-0.037	-11.38	<.0001
TERM	0.002	2.50	0.0126	0.003	3.13	0.0018
GOV	-0.067	-6.66	<.0001	-0.065	-6.31	<.0001
ARM_DUM	0.029	1.75	0.0795	0.031	1.87	0.0621
DOWNPAY_07	0.006	20.49	<.0001	0.005	17.22	<.0001
DOWNPAY_07_SQ	0.000	-9.48	<.0001	0.000	-7.80	<.0001
CLTV	0.494	9.57	<.0001			
CLTV_85_90				0.063	3.43	0.0006
CLTV_90_95				0.076	4.33	<.0001
CLTV_95_100				0.073	3.86	0.0001
CLTV_100_105				0.079	4.18	<.0001
CLTV_105_110				0.115	2.91	0.0037
CLTV_GT_110				0.204	4.98	<.0001
PTI	2.043	38.09	<.0001	2.174	41.98	<.0001
WHEN	0.002	0.71	0.4763	0.003	0.90	0.3672
MSA dummies		Yes			Yes	
N		3006			3006	
R-Square		0.7684			0.7636	
Adj R-Sq		0.7551			0.7496	

Turning to loan characteristics, the mortgage interest rate is negatively related to housing demand. A one percentage-point increase is expected to decrease housing demand by 4 percent. Also, a ten-year increase in term is expected to increase housing demand by two to three percent. Obtaining a government-insured loan is expected to decrease housing demand by seven percent, consistent with the loan size limit rules in government-insured loans. Receiving an ARM is expected to increase housing demand

by three percent, showing the mitigating effect of income constraint. A 10,000 dollar increase in down payment is expected to increase housing demand by five to six percent.

The variables of primary interest, the PTI ratio and the CLTV ratio dummies show a statistically significant, positive effect on housing demand both in Model 1 and Model 2. An increase of 0.05 in PTI ratio is expected to increase housing demand by ten percent. In Model 1, an increase of 0.05 in CLTV ratio is expected to increase housing demand by two percent. In Model 2, a household with a loan whose CLTV ratio is between 0.85 and 0.90 is expected to exhibit a housing demand of six percent more than a household with a loan whose CLTV ratio is less than 0.85 holding other variables constant. A household receiving a loan whose CLTV ratio is between 0.90 and 0.95 or between 0.95 and 1.00 is expected to exhibit about seven percent greater housing demand. A household receiving a loan whose CLTV ratio is between 1.00 and 1.05, between 1.05 and 1.10, or greater than 1.10 is expected to exhibit an 8, 12, and 20 percent greater housing demand than a household receiving a loan whose CLTV is less than 0.85 respectively.

The models for neighborhood quality include the same set of explanatory variables found in the housing demand in Model 2. Initially, standard binary logit models were estimated for 18 neighborhood quality variables after excluding four variables with sample sizes of less than 2,000. Among the 18 models, another five models were excluded. Three models of "No Mobile Homes", "No Factories or Institutional Structures", and "No Bad Smells" were excluded because these models failed to reject the null hypothesis of all zero coefficients of explanatory variables, based on log likelihood ratio and score tests. Models for "No Railroad, Airport, or Highway" and

"Satisfactory Neighborhood Shopping" were excluded because the probabilities of the selection of a neighborhood with these expected qualities is not influenced by household income, indicating that the qualities are not normal goods, or, more plausibly, these variables do not accurately measure better neighborhoods in the home-buying process. The estimation results of the remaining 13 models of neighborhood qualities are discussed below, and the effects of variables across the models are reported in the Appendix A.

Among these 13 models, only one model on "No Apartment Buildings" show estimated results consistent with the hypothesis on both PTI and CLTV ratios. In this model, the coefficients for the PTI ratio and all the CLTV ratio dummies except two are positive and statistically significant. Another four models on "No Business or Institutions", "No Parking Lots", "High Neighborhood Rating", and "Stores within 15 minutes" show results consistent with the hypothesis for the PTI ratio and partially consistent with the hypothesis for the CLTV ratio. The coefficient for the PTI ratio is positive and statistically significant and at least one CLTV ratio dummies are positive and statistically significant. Other CLTV ratio dummies are generally positive, but not statistically significant. Incidentally, the data reflects that the "Neighborhood Store within 15 Minutes" variable does not appear to better neighborhood quality because it measures the proximity to unwanted land uses or commercial areas. Thus, for this variable, a negative coefficient reflects the hypothesized effect. The models of "No Townhouses or Rowhouses", "No Abandoned Buildings", "No Buildings with Bars on Windows", "No Trash or Junk", No Roads Needing Repairs", and "No Serious Neighborhood Crime" show a statistically significant effect for PTI ratio only. The

remaining two models of “Open Spaces” and “Satisfactory Police Protection” do not show statistically significant effects for PTI ratio or CLTV ratio dummies. In sum, among the 13 logit models, 11 models show statistically significant positive effects for the PTI ratio and five models show statistically significant positive effects for at least one CLTV ratio dummies. Two models show no significant effects for either the PTI ratio or the CLTV ratio dummies. The coefficients for the log of income, the PTI ratio, and the CLTV dummies are reported in Table 10.

I also estimated the models without PTI ratio variable. Since PTI ratio and CLTV ratio variables are highly correlated, it might be difficult to isolate the effect of CLTV ratio. The results show general improvement in the effects of CLTV ratio dummies (Table 11). After dropping PTI ratio from the models, most of CLTV dummies in “No Townhouses or Rowhouses” model and all CLTV dummies in “No Apartment Buildings” model show statistically significant, positive effects. Also, one to three CLTV dummies in “No Business or Institutions”, “Open Spaces”, “No Buildings with Bars on Windows”, “No Parking Lots”, “High Neighborhood Rating”, “Neighborhood Stores within 15 Minutes”. Thus, the effect of some CLTV ratio dummies disappears when PTI ratio is controlled because these variables are highly correlated. When we consider the casual relationship between these variables, it is difficult to think that high PTI ratio causes high CLTV ratio. It is more plausible that a high CLTV ratio causes an increase in the PTI ratio. It seems that the effect of CLTV ratio is difficult to isolate from the effect of PTI because they are closely related. Since PTI ratio has its own effects independent from reflecting CLTV ratio’s effect, the PTI ratio shows more significant results in the models. The neighborhood qualities most responsive to CLTV ratio are “No Apartment

Buildings" , "No Townhouses and Rowhouses", and "No Parking Lots". These neighborhoods may represent suburban single-family neighborhoods.

Table 10 Logit Coefficients of the Log of Income, High-CLTV, and PTI Variables

Var. #	Variable	Log of Income	PTI	CLTV						Pseudo-R-squared
				0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	≤ 1.10	
1	No Townhouses or Rowhouses	0.760 ***	4.090 ***	0.280	0.316	0.250	0.180	0.462	0.813	0.307
2	No Apartment Buildings	1.035 ***	4.134 ***	0.226	0.463 **	0.250	0.451 **	1.114 **	0.980 *	0.275
4	No Business or Institutions	0.506 ***	1.949 ***	0.548 **	0.214	-0.002	0.128	0.262	0.551	0.187
6	Open Spaces	0.231 **	0.676	0.074	-0.115	0.242	0.304	-0.103	0.310	0.120
7	No Abandoned Buildings	0.812 ***	2.230 *	0.924	0.041	-0.013	0.384	-0.209	0.048	0.252
8	No Buildings with Bars on Windows	0.652 ***	2.121 **	0.557	0.497	0.121	-0.088	-0.645	-0.193	0.330
9	No Trash or Junk	0.689 ***	2.106 *	0.029	-0.003	-0.755 **	-0.685 *	-0.937	-1.124	0.171
10	No Parking Lots	0.865 ***	3.961 ***	0.320	0.255	0.080	0.142	0.435	0.975	0.202
11	No Roads Needing Repairs	0.258 **	1.645 ***	-0.111	-0.076	0.073	-0.089	-0.039	-0.029	0.148
13	High Neighborhood Rating	0.630 ***	2.936 ***	0.432 **	-0.223	0.013	0.062	-0.552	0.559	0.142
15	Satisfactory Police Protection	0.491 *	-0.655	-0.053	-0.175	-1.095	-0.868	-1.011	-1.209	0.214
19	Neighborhood Stores within 15 Minutes	-0.425 ***	2.806 ***	0.181	-0.068	-0.420	-0.254	0.100	-1.255 **	0.221
20	No Serious Neighborhood Crime	0.680 ***	2.650 ***	0.123	0.161	0.049	0.107	-0.182	0.015	0.165

*** Significant at 0.01 level

** Significant at 0.05 level

* Significant at 0.10 level

Table 11 Logit Coefficients of the Log of Income and High-CLTV (Without PTI Variable)

Var. #	Variable	Log of Income	CLTV 0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	≤ 1.10	Pseudo-R-squared
1	No Townhouses or Rowhouses	0.183 *	0.503 **	0.550 ***	0.418 *	0.377	0.599	1.193 **	0.290
2	No Apartment Buildings	1.035 ***	0.425 *	0.678 ***	0.422 *	0.632 ***	1.295 **	1.308 **	0.255
4	No Business or Institutions	0.222 **	0.647 ***	0.323 *	0.080	0.212	0.339	0.682	0.182
6	Open Spaces	0.138 *	0.110	-0.078	0.270	0.335 *	-0.071	0.365	0.119
7	No Abandoned Buildings	0.470 **	1.009 *	0.166	0.063	0.437	-0.138	0.155	0.248
8	No Buildings with Bars on Windows	0.329 **	0.665 *	0.603 *	0.202	-0.015	-0.541	-0.098	0.327
9	No Trash or Junk	0.380 **	0.133	0.109	-0.671	-0.596	-0.859	-0.998	0.167
10	No Parking Lots	0.301 **	0.530 **	0.489 **	0.274	0.349	0.624	1.359 **	0.184
11	No Roads Needing Repairs	0.027	-0.029	0.010	0.139	-0.016	0.032	0.089	0.144
13	High Neighborhood Rating	0.215 **	0.580 ***	-0.059	0.143	0.198	-0.408	0.796 *	0.130
15	Satisfactory Police Protection	0.594 ***	-0.081	-0.212	-1.121 **	-0.897 *	-1.043	-1.250	0.213
19	Neighborhood Stores within 15 Minutes	-0.049	0.008	-0.248	-0.570 *	-0.433	-0.104	-1.521 **	0.213
20	No Serious Neighborhood Crime	0.306 **	0.236	0.284	0.123	0.190	-0.100	0.145	0.158

*** Significant at 0.01 level

** Significant at 0.05 level

* Significant at 0.10 level

With regard to variables other than PTI and CLTV ratios, by construction, the log of income is positive and statistically significant in all models (Table 10). The effects of the log of housing price are negative and statistically significant in only 1 of 13 models. In our sample, most of the neighborhood qualities do not appear to be responsive to MSA housing price. The effects of household characteristics other than income vary according to the models. The effect of household size is statistically significant in 7 of 13 models. Larger households are more likely to choose a neighborhood with no townhouses or rowhouses, no apartment buildings, no business or institutions, no abandoned buildings, no parking lots, but are less likely to choose a neighborhood with satisfactory police protection and no serious neighborhood crime. It seems that larger households choose higher-quality neighborhoods in terms of objective criteria, but these households are less satisfied with their police protection probably because of the presence of children. A household with an older head is more likely to choose a neighborhood with no apartment buildings and no roads needing repairs; however this variable was not statistically significant in models of other neighborhood qualities. Compared to a male-headed household, a married-couple household is more likely to choose a neighborhood with no apartment buildings, no business or institutions, no parking lots, and a high neighborhood rating. Compared to a male-headed household, a female-headed household is less likely to choose a neighborhood with no roads needing repairs. Education showed statistically significant effect in five models. Compared with a household with a head of household with no high school diploma, a household with a head of household who has a high school diploma is more likely choose a neighborhood without apartments. Compared with a household with a head of household with no high school diploma, a household

with a head of household who has a bachelor's degree is more likely choose a neighborhood with open spaces. Compared with a household with a head of household with no high school diploma, a household with a head of household who has more education is more likely choose a neighborhood with no roads needing repairs. Compared with a household with a head of household with no high school diploma, a household with a head of household who has a high school diploma is less likely choose a neighborhood with stores within 15 minutes. Surprisingly, compared with a household with a head of household with no high school diploma, a household with a head of household with a higher education is less likely to choose a neighborhood with no townhouses or rowhouses. In our sample, households with more education seem to be more willing to live in townhouses.

The effects of race and ethnicity are significant in some models (Table 13). Compared with a non-Hispanic white household, a black household is less likely to choose a neighborhood with no business or institutions, no abandoned buildings, no building with bars on windows, and no serious neighborhood crime. However, a black household is more likely to live in a neighborhood with a high neighborhood rating. Given the subjective nature of neighborhood ratings, blacks may simply be more generous in rating their own neighborhoods. Compared to a non-Hispanic white household, a Hispanic household is likely to choose a neighborhood with no serious neighborhood crime and with a high neighborhood rating. Compared to a non-Hispanic white household, an Asian household is less likely to choose a neighborhood with no townhouses or rowhouses and more likely to choose a neighborhood with no serious crime. Compared to a non-Hispanic white household, a household of other race is less

likely to choose a neighborhood with no townhouses or rowhouses and more likely to choose a neighborhood with no roads needing repairs. Overall, household characteristics other than income are only statistically significant in certain variables (Tables 12 and 13).

Among loan characteristics other than PTI and CLTV ratios, the mortgage interest rate and down payment are often statistically significant, but the terms, government-insured loan status, and existence of an ARM are not significant (Table 13). The year-trend variable is negative and statistically significant in 5 of 13 models, but positive and statistically significant in 2 models. (Table 14).

Next, I calculate the average marginal effects of important variables across the models: the log of income, the PTI ratio, the CLTV ratio dummies, and the down payment for the ten models (Tables 15 and 16). A ten percent change in income is expected to increase the probability of choosing a better neighborhood by 0.02 to 8.12, depending on the specific type of neighborhood quality, holding other variables constant. Although the effects of income on the probability of choosing a better neighborhood are statistically significant, the magnitude of these effects is generally modest. This same trend holds true for the down payment variable. A 10,000 percent increase in down payment is expected to increase the probability of choosing a better neighborhood by less than 0.01. The effect of the square of down payment is statistically significant in five models.

The magnitude of the marginal effects of the PTI and CLTV ratio is somewhat modest. A 0.05 increase in PTI ratio is expected to increase the probability of choosing a better neighborhood by 0.003 to 0.03, depending on the neighborhood quality variable (Table 16). Loans with a CLTV ratio between 0.90 and 0.95, between 1.00 and 1.05,

between 1.05 and 1.10, and greater than 1.10 are expected to increase the probability of choosing neighborhoods without apartment buildings by 0.064, 0.062, 0.133, and 0.121, relatively to loans with a CLTV ratio less than 0.85. Loans with a CLTV ratio between 0.85 and 0.90 are expected to increase the probability of choosing neighborhoods without business or institutions by 0.082. Loans with a CLTV ratio greater than 1.10 are expected to increase the probability of choosing neighborhoods without parking lots and stores within 15 minutes by 0.115 and 0.157. If the PTI ratio variable is omitted from the model, the magnitudes of CLTV ratio dummies generally increase.

Table 12 Logit Coefficients of Explanatory Variables (1)

Var. #	Variable	Log of HPI	PER	HHAGE	MARRIED	FEMALE HEAD	HIGH	BACH	PGRAD
1	No Townhouses or Rowhouses	-0.750	0.229 ***	0.001	0.146	-0.244	-0.417 *	-0.686 ***	-0.672 **
2	No Apartment Buildings	-1.277 **	0.144 ***	0.011 **	0.278 *	-0.108	0.369 *	0.067	-0.114
4	No Business or Institutions	-0.680	0.084 **	0.002	0.414 ***	0.093	0.012	-0.047	0.095
6	Open Spaces	0.314	-0.052	0.004	0.138	0.063	0.148	0.370 *	0.313
7	No Abandoned Buildings	-0.086	0.168 *	0.012	0.106	-0.016	-0.149	0.246	-0.042
8	No Buildings with Bars on Windows	-0.022	-0.041	0.000	0.121	0.108	0.097	0.044	-0.437
9	No Trash or Junk	-0.158	0.005	0.009	0.283	-0.009	-0.088	0.126	-0.055
10	No Parking Lots	-0.224	0.181 ***	0.006	0.271 *	0.027	-0.140	-0.345	-0.486 *
11	No Roads Needing Repairs	0.059	-0.039	0.012 ***	0.084	-0.243 *	0.314 *	0.485 **	0.415 **
13	High Neighborhood Rating	1.504 ***	-0.048	0.004	0.403 ***	0.077	-0.131	-0.108	-0.252
15	Satisfactory Police Protection	1.255	-0.145 **	-0.007	0.124	0.377	0.311	0.427	0.478
19	Neighborhood Stores within 15 Minutes	1.063	0.032	-0.001	-0.318	-0.172	-0.789 **	-0.451	-0.561
20	No Serious Neighborhood Crime	-0.568	-0.101 **	0.001	0.180	-0.104	0.098	0.149	-0.119

*** Significant at 0.01 level

** Significant at 0.05 level

* Significant at 0.10 level

Table 13 Logit Coefficients of Explanatory Variables (2)

Var. #	Variable	BLACK	HISPANIC	ASIAN	OTHERS	INTEREST	TERM	GOV	ARM
1	No Townhouses or Rowhouses	0.259	0.116	-0.609 ***	-0.945 *	-0.027	0.008	-0.120	0.080
2	No Apartment Buildings	0.304	-0.112	-0.282	0.459	-0.091	0.005	-0.175	0.035
4	No Business or Institutions	-0.543 ***	-0.127	-0.271	0.581	-0.103	0.002	0.038	0.038
6	Open Spaces	-0.020	0.044	0.004	0.195	0.020	-0.011	0.053	0.208
7	No Abandoned Buildings	-1.439 ***	-0.401	-0.427	-0.393	-0.168 **	0.039 **	0.197	-0.489
8	No Buildings with Bars on Windows	-0.660 ***	0.075	0.182	-0.733	-0.112 **	-0.002	-0.029	0.046
9	No Trash or Junk	-0.289	0.150	0.217	0.769	-0.026	0.010	0.029	-0.182
10	No Parking Lots	0.287	0.021	-0.324	-0.361	-0.059	0.007	0.095	0.010
11	No Roads Needing Repairs	0.036	0.036	0.263	1.388 **	-0.061 *	0.009	0.066	-0.233
13	High Neighborhood Rating	0.297 *	0.432 ***	-0.086	-0.005	-0.019	0.004	-0.067	0.044
15	Satisfactory Police Protection	-0.061	-0.058	-0.100	21.126	-0.015	0.004	0.238	0.345
19	Neighborhood Stores within 15 Minutes	0.187	-0.147	-0.334	0.579	0.280 ***	-0.013	0.073	-0.331
20	No Serious Neighborhood Crime	-0.352 *	0.794 ***	0.692 **	0.275	-0.083 *	0.004	0.107	0.153

*** Significant at 0.01 level

** Significant at 0.05 level

* Significant at 0.10 level

Table 14 Logit Coefficients of Explanatory Variables (3)

Var. #	Variable	DOWN PAY	DOWN PAY SQUARE	WHEN
1	No Townhouses or Rowhouses	0.008 **	0.000	-0.100 **
2	No Apartment Buildings	0.009 **	0.000	-0.081 *
4	No Business or Institutions	0.005	0.000	-0.065 *
6	Open Spaces	0.003	0.000	0.014
7	No Abandoned Buildings	0.007	0.000	-0.099
8	No Buildings with Bars on Windows	0.004	0.000	-0.116 *
9	No Trash or Junk	-0.007	0.000	0.067
10	No Parking Lots	0.005	0.000	-0.111 ***
11	No Roads Needing Repairs	0.002	0.000	-0.036
13	High Neighborhood Rating	0.009 ***	0.000 *	0.084 **
15	Satisfactory Police Protection	-0.014	-0.000	-0.043
19	Neighborhood Stores within 15 Minutes	-0.014 **	0.000 **	0.270 ***
20	No Serious Neighborhood Crime	0.007 *	0.000	-0.029

*** Significant at 0.01 level

** Significant at 0.05 level

* Significant at 0.10 level

Table 15 Marginal effects of income and down payment

Var. #	Variable	ME ln(INC)	ME DOWN PAY
1	No Townhouses or Rowhouses	0.103 ***	0.001 **
2	No Apartment Buildings	0.140 ***	0.001 **
4	No Business or Institutions	0.081 ***	0.005
6	Open Spaces	0.045 **	0.001
7	No Abandoned Buildings	0.812 ***	0.007
8	No Buildings with Bars on Windows	0.043 ***	0.000
9	No Trash or Junk	0.040 ***	0.000
10	No Parking Lots	0.122 ***	0.001
11	No Roads Needing Repairs	0.051 **	0.000
13	High Neighborhood Rating	0.119 ***	0.002 ***
15	Satisfactory Police Protection	0.002 *	-0.001
19	Neighborhood Stores within 15 Minutes	-0.041 ***	-0.001 **
20	No Serious Neighborhood Crime	0.07 ***	0.001 *

Table 16 Marginal effects of PTI ratio and CLTV ratio dummies

Var. #	Variable	ME PTI	ME CLTV					
			0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	≤ 1.10
1	No Townhouses or Rowhouses	0.553 ***	0.038	0.043	0.034	0.025	0.061	0.100
2	No Apartment Buildings	0.561 ***	0.033	0.064 **	0.036	0.062 *	0.133 **	0.121 *
4	No Business or Institutions	0.313 ***	0.082 **	0.035	0.000	0.021	0.042	0.083
6	Open Spaces	0.132	0.014	-0.021	0.047	0.060	-0.019	0.061
7	No Abandoned Buildings	0.067 *	0.022	0.001	0.000	-0.008	0.002	0.067
8	No Buildings with Bars on Windows	0.141 **	0.033	0.030	0.008	-0.006	-0.053	-0.014
9	No Trash or Junk	0.122 **	0.001	0.000	-0.046 **	-0.040 *	-0.061	-0.079
10	No Parking Lots	0.560 ***	0.045	0.036	0.012	0.021	0.059	0.115 *
11	No Roads Needing Repairs	0.325 ***	-0.022	-0.015	0.014	-0.018	-0.008	-0.006
13	High Neighborhood Rating	0.557 ***	0.076	-0.044	0.002	0.012	-0.114	0.096
15	Satisfactory Police Protection	-0.028	-0.002	-0.006	-0.052	-0.037	-0.046	-0.060
19	Neighborhood Stores within 15 Minutes	-0.273 ***	0.015	-0.006	-0.043	-0.025	0.009	-0.157 *
20	No Serious Neighborhood Crime	0.273 ***	0.013	0.016	0.005	0.011	-0.212	0.002

Summary of Results

In sum, I test two hypotheses positing that high PTI and LTV ratios increase housing demand and neighborhood quality, holding other characteristics constant, using linear and logit models respectively. The estimation results show that a household receiving a loan with 0.05 higher PTI ratio is expected to consume ten percent more housing, holding other variables constant. Also, a household receiving a loan with CLTV ratio between 0.85 and 0.90, between 0.90 and 0.95, between 0.95 and 1.00, or between 1.00 and 1.05 is expected to consume six to eight percent more housing than a household with a CLTV ratio less than 0.85, holding other variables constant. A household receiving a loan with CLTV ratio between 1.05 and 1.10 or greater than 1.10 is expected to consume 12 or 20 percent more housing, respectively, than a household with a CLTV ratio less than 0.85, holding other variables constant.

Regarding neighborhood quality variables, a household receiving a loan with a higher PTI ratio is expected to increase the probability of purchasing a home in a neighborhood with no townhouses or rowhouses, no apartment buildings, no business or institutions, no abandoned buildings, no building with bars on windows, no trash or junk, no parking lots, no roads needing repairs, high neighborhood rating, no stores within 15 minutes, and no serious neighborhood crime, holding other variables constant.

A household receiving a loan with a CLTV ratio higher than 0.85 is expected to increase the probabilities of purchasing a home in a neighborhood with no apartment building, holding other variables constant. Only some of CLTV ratio dummies have statistically significant effect on choosing neighborhoods with no business or institutions, no parking lots, high neighborhood ratings, and no stores within 15 minutes. After

omitting PTI ratio in the models, most CLTV ratio dummies have a statistically significant, positive effect on choosing neighborhoods with no apartment buildings and no townhouses or rowhouses. Also, some CLTV ratio dummies have a statistically significant, positive effect on choosing neighborhoods with no business or institutions, open space, no buildings with bars on windows, no parking lots, high neighborhood rating, and no stores within 15 minutes. This change occurs because PTI ratio and CLTV ratio are closely correlated. The explanatory power of neighborhood quality variable models is not as good as that of housing demand model. This requires the more objective neighborhood quality measures such as neighborhood income and housing unit characteristics variables. The neighborhood quality variables that have the most statistically significant effects for PTI and CLTV ratios are those evaluated by interviewers, as expected.

CHAPTER 5
IMPACT OF HIGH-LEVERAGE HOME LENDING ON RACIAL/ETHNIC SEGREGATION

As discussed in Chapters 3 and 4, borrowers who are credit-constrained by low income and wealth and by restrictive underwriting requirements may benefit from increased LTV and PTI ratios because they can purchase more expensive homes. Due to the complementary nature of housing unit and neighborhood qualities and the nature of exclusionary land use regulations and practices, high-leverage loans may enable some buyers to purchase homes in higher quality neighborhoods compared to those with otherwise similar household characteristics. Since the high-leverage, subprime loans prevalent in the middle-2000s went disproportionately to minorities, more minority borrowers mitigated their income and wealth constraints and purchased homes in higher quality neighborhoods relative to non-Hispanic white borrowers. In addition, assuming a positive correlation between neighborhood quality and the proportion of non-Hispanic whites in a neighborhood, the use of high-leverage loans might serve to mitigate racial and ethnic segregation.

This chapter empirically tests the hypothesis that homebuyers are less racially segregated in a metropolitan area with a higher share of high-leverage loans when other metropolitan characteristics are equal. HMDA and ACS data provide the primary data sources.

Methodology

Based on the discussion in the previous section, I estimate an empirical model explaining the metropolitan-area level racial/ethnic segregation utilizing proxies for the

racial prejudice and discrimination level of non-Hispanic whites, racial differences in socioeconomic and household characteristics, and metropolitan ecological context.

The primary data source for mortgage characteristics is HMDA data, which have information on the disposition of mortgage applications, the characteristics of loans, the race, ethnicity and income of applicants, and the census tract location of the mortgaged house. After several revisions, the HMDA covers most depository institutions including banks, savings associations, and credit unions, as well as non-depository institutions such as mortgage companies. Very small lending institutions or those without a branch in a metropolitan area are exempted (McCoy, 2007). The data cover approximately 80 percent of all of the nations' home-lending activity (Avery, Brevoort, & Canner, 2007). The coverage is expected to be considerably higher in metropolitan areas, the focus here, than in non-metropolitan or rural areas.

The Federal Reserve Board's Regulation C, which implements HMDA's data collection, was significantly revised in 2002. The revised regulations are reflected in the data since 2004, and thus researchers must exercise caution when comparing data before and since 2004. Beginning in 2004, the data began providing additional information, including whether pre-approval is requested, lien status, whether the property mortgaged is manufactured home, whether the loan is subject to the protections of the Home Ownership and Equity Protection Act (HOEPA), whether the loan is sold to private secondary markets, and loan pricing information. In addition, since 2004, the data has employed different rules for reporting the race and ethnicity of applicants.

The primary data source for MSA characteristics other than loans will be the 2005-2007 ACS three- and one-year estimates data. As discussed more fully below, this

study must use instruments to predict the proportion of high-leverage loans. The data sources for these instruments are the anti-predatory law index developed by Bostic and his colleagues (2008), the state foreclosure law characteristics coded by Cutts and Merill (2008), and the Federal Housing Finance Agency's (FHFA) house price index. Bostic and his colleagues (Bostic, et al., 2008) analyzed the statues governing lending in all 50 states to identify anti-predatory laws. They also measured the strength of the laws in three dimensions: coverage, restriction, and enforcement. The enforcement index is used as an instrumental variable because this measure is significantly and positively associated with the probability of subprime origination. The enforcement index is scored by two aspects: assignee liability and lender enforcement methods. Cutts and Merill (2008) analyzed foreclosure laws in every state and identified whether the state's most commonly used foreclosure process is judicial or non-judicial.

The dependent variables are two measures of homebuyers' racial/ethnic segregation level: dissimilarity and isolation indices. Homebuyers are identified from the HMDA data by identifying first-lien, home purchase loans for owner-occupied, single-family units. The racial/ethnic categories of non-Hispanic whites, blacks regardless of ethnicity, and Hispanics are used because of comparability with the ACS data. The ACS data does not provide socioeconomic data for non-Hispanic blacks. The dissimilarity index measures how the two racial/ethnic groups are unevenly distributed among census tracts within a metropolitan area. The dissimilarity index is calculated by the formula:

$$Dissimilarity\ Index = \frac{1}{2}\sum_{i}\left|\frac{w_i}{W} - \frac{m_i}{M}\right|$$

where w_i is the number of non-Hispanic white buyers in census tract *i*, *W* is the total non-Hispanic white buyers in the metropolitan area, m_i is the number of minority buyers (black or Hispanic buyers) in census tract *i*, and *M* is the total minority buyers (black or Hispanic buyers) in the metropolitan area. The index is interpreted as the proportion of the minority buyers who would have to buy in other census tracts to achieve a uniform distribution of minority homebuyers across all tracts in the metropolitan area.

The isolation index measures the degree to which the members of one group are exposed only to other members of the same group. The isolation index is calculated by the formula:

$$Isolation\ Index = \sum_i \left(\frac{m_i}{M}\right)\left(\frac{m_i}{t_i}\right)$$

where m_i is the number of minority buyers (black or Hispanic buyers) in census tract *i*, *M* is the total minority buyers (black or Hispanic buyers) in the metropolitan area and t_i is the number of total buyers in census tract *i*. The index is interpreted as the probability that a minority homebuyer buys a home in a census tract where a homebuyer of the same racial or ethnic group also buys. The isolation index is sensitive to the proportion of the homebuyers in the metropolitan area within the minority group. When two metropolitan areas are similar in terms of the dissimilarity index, the metropolitan area with the larger share of buyers who are in the minority group would show a higher isolation index (Massey & Denton, 1988). Overall, four models are estimated: white-black dissimilarity, white-Hispanic dissimilarity, black isolation, and Hispanic isolation.

For the purposes of illustration, the Atlanta, GA and Chicago, IL-IN-WI MSAs are compared in Figures 11 and 12. The two MSAs have similar isolation indices (0.60 and 0.58), but dissimilarity index of Chicago MSA (0.74) is greater than that of Atlanta MSA (0.59). Atlanta's black homebuyers in 2005 and 2006 are more dispersed throughout the MSA than Chicago's, and this is reflected in dissimilarity indices. Chicago has many more white-dominated tracts than Atlanta. Since the isolation index is sensitive to the proportion of blacks in an MSA, the isolation index similar despite the impression in the figures. The proportion of Atlanta's homebuyers who were black (34%) was much greater than for Chicago (13%) in 2005-2006.

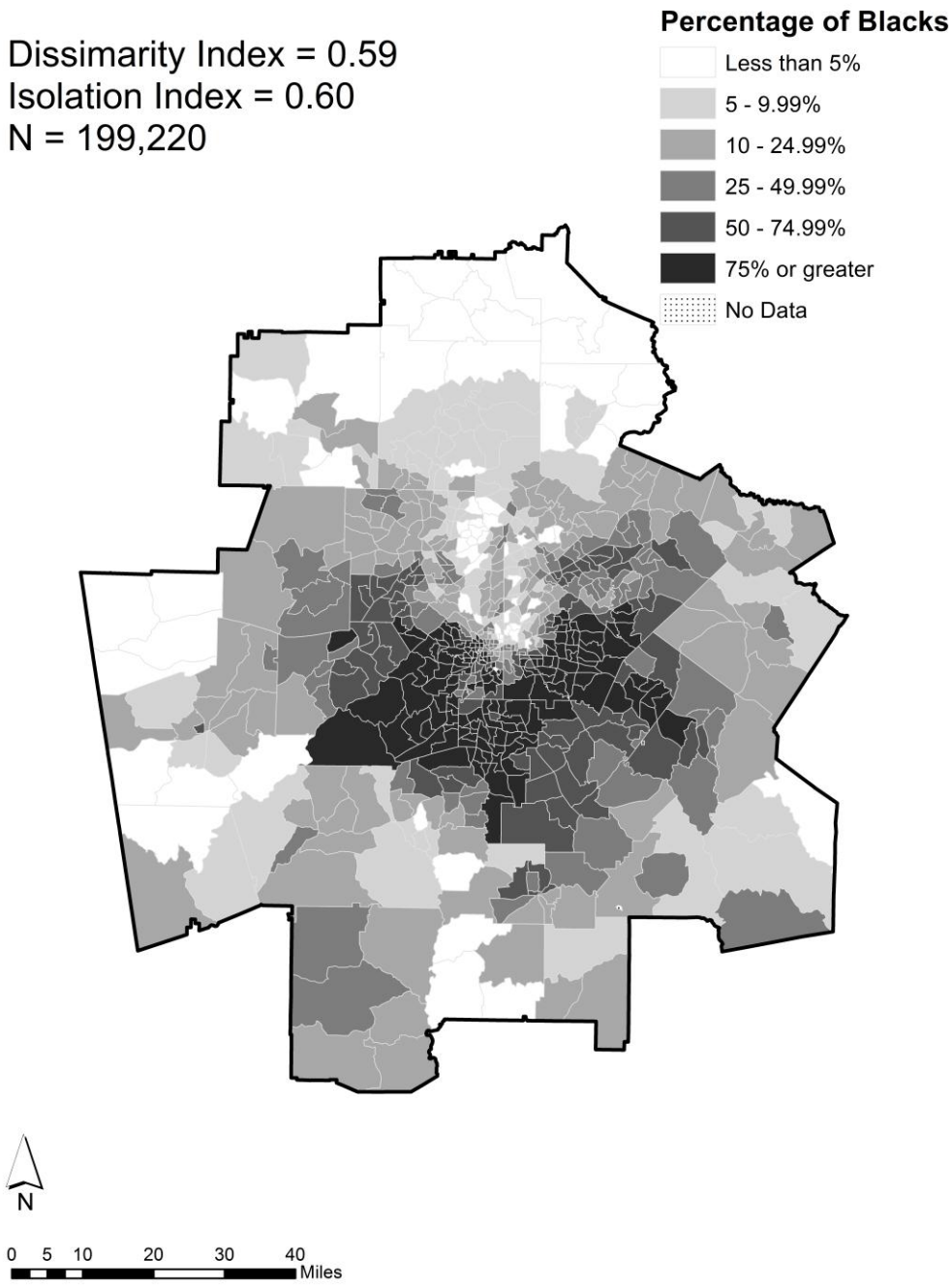

Figure 11 Dissimilarity Index, Isolation Index, and Percentage of Blacks of Census Tracts, Atlanta, GA Metropolitan Area

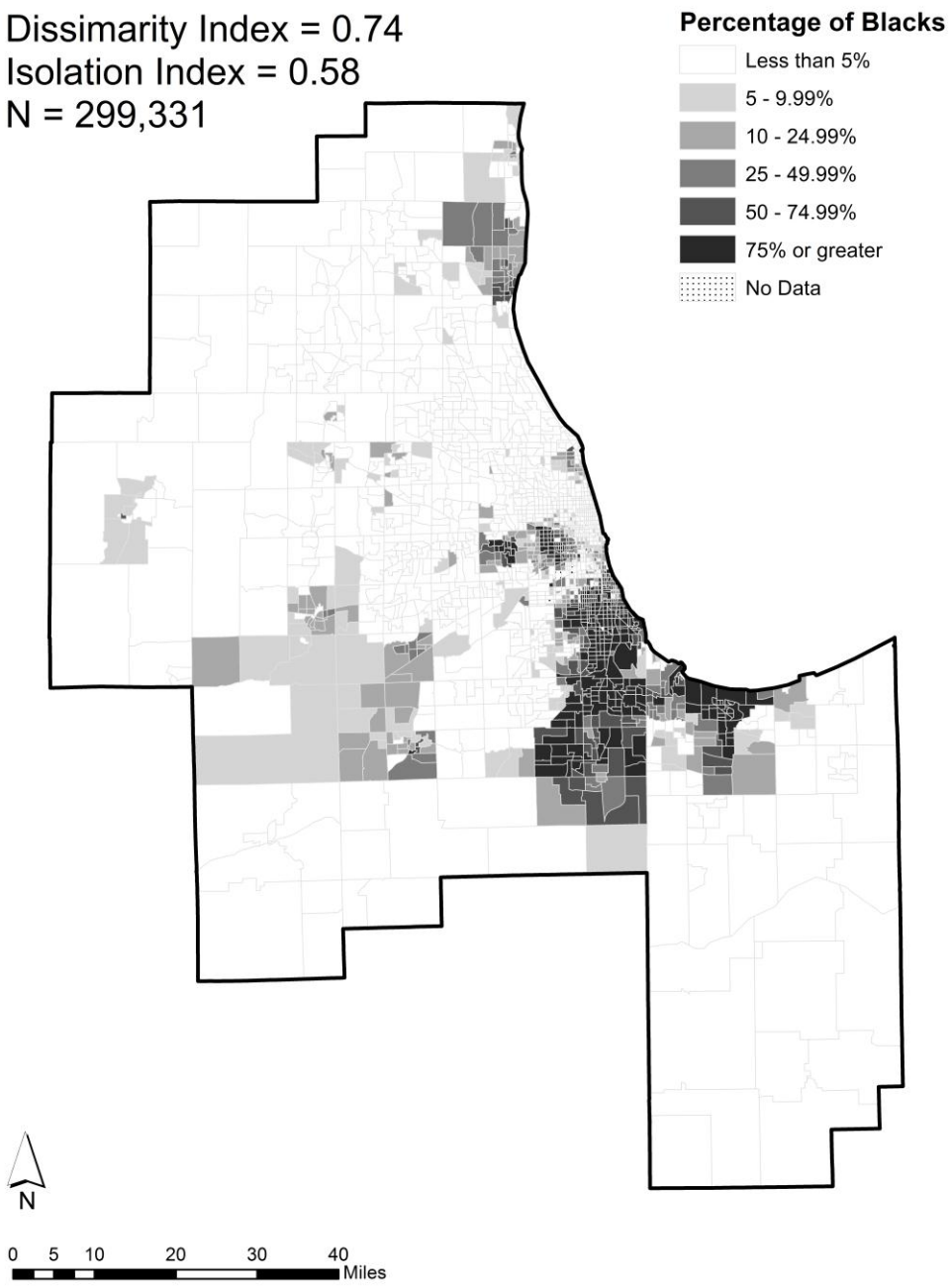

Figure 12 Dissimilarity Index, Isolation Index, and Percentage of Blacks of Census Tracts, Chicago, IL-IN-WI Metropolitan Area

The explanatory variable of primary interest to this study is the proportion of

high-leverage loans. Since the LTV and PTI ratios are not available in publicly available data, a proxy variable, the proportion of higher-priced loans identified in the HMDA, is used. Since 2004, the loans' rate spread is reported in the HMDA data if the loan's annual percentage rate (APR) exceeds a comparable Treasury security's rate by three percentage points. These higher-priced loans could be the result of several risk factors, such as lower credit score, higher LTV and PTI ratios, the poor quality of income documentation and other loan features. Although earlier subprime lending began by serving mainly borrowers with blemished credit histories, the nature of subprime lending evolved during the 2000s. Borrower credit scores in subprime loan pools have been increasing steadily, and the gaps between the prime and subprime loan pools substantially narrowed during the 2000s. Chomsisengphet and Pennington-Cross (2006) report that the average credit score rose from under 622 in 2000 to over 651 in 2004 in their national sample. Foote and his colleagues (Foote, et al., 2008) also report that the proportion of borrowers with a credit score of 620 or higher rose from less than 40 percent in 1999 to around 70 percent in 2004 in their sample of three New England states. In contrast, other characteristics such as LTV, PTI, and the proportion of the loans with no or low income documentation increased. Chomsisengphet and Pennington-Cross found that the proportion of loans with a relatively high LTV ratio, around 0.9, has increased since 2000. Foote et al. (2008) found that the average LTV ratio for borrowers with higher credit scores has steadily increased and reached about 95 percent in 2005 and 2006; that the average PTI ratio for all borrowers increased to over 40 percent; and that the proportion of fully documented loans for borrowers with higher credit scores decreased to 40 percent in 2005 and 2006. Accordingly, a large proportion of subprime loans can be

explained by higher LTV, PTI, and other factors enabling borrowers to get larger loans such as less stringent requirements for income documentation.

Any precise measurement of racial preferences or discrimination by existing white residents is generally not feasible. Some studies rely on preference surveys and discrimination audits by paired testers, but these data are not available for numerous metropolitan areas or multiple years. Possible proxy measures are the age, income, and educational level of non-Hispanic whites. Younger, higher-income, and more educated individuals are likely to be more tolerant of racial/ethnic minorities (Galster & Keeney, 1988). To control the level of non-Hispanic whites' racial preference and discrimination, I include three proxy variables: the proportion of persons younger than 45, the median household income, and the proportion of persons over age 25 with at least a bachelor's degree for non-Hispanic whites. All of these variables are expected to be negatively associated with the segregation level.

To control the effect of interracial differences in socioeconomic and household characteristics, I include the following independent variables: the interracial differences in median household income, the proportion of persons over age 25 with at least a bachelor's degree, and the proportions of households that are female-headed families and married-couple families. These variables are calculated by subtracting the value for each characteristic of the minority group from that of non-Hispanic whites. The difference in the proportion of households that are female-headed families is expected to be negatively associated with the segregation level, and all other variables are expected to be positively associated with the segregation level.

Other metropolitan area characteristics such as population size, the proportion of

the population in the minority group, and the proportion of houses built in 2000 or later are included as control variables. The population size and the minority group proportion are expected to be positively associated with segregation level, but the proportion of houses built in 2000 or later is expected to be negatively associated with segregation level. For models involving Hispanic segregation, a variable capturing cultural assimilation, the proportion of Hispanic foreign-born population, is included and is expected to be positively associated with the segregation level, because the foreign-born population is less likely to be assimilated into mainstream society.

The following model of racial/ethnic segregation level among homebuyers in 2005 and 2006 in metropolitan area *i* is estimated as follows:

$$SEG_i = \alpha_0 + \beta' \mathrm{x}_i + \gamma z_i + e_i$$

where *SEG* is the dissimilarity or isolation index, x is the vector of control variables of metropolitan characteristics described above, *z* is the proportion of high-leverage loans, β and γ are unknown parameters, and *e* is the random error term. Since I argue that minority use of high-leverage loans would mitigate the segregation level, the expected sign of γ is negative.

However, the proportion of high-leverage loans might suffer from an endogeneity problem, especially in light of recent evidence of the effect of segregation on the proportion of higher-priced loans. Recent research finds empirical evidence for the positive effect of segregation on the proportion of subprime loans (Been, et al., 2009; Squires, et al., 2009). When traditional lenders avoid segregated neighborhoods and subprime lenders target these neighborhoods, the segregation level is positively

associated with the proportion of subprime or higher-priced loans (Hyra, et al., 2012; Williams, et al., 2005).

Because the proportion of high-leverage loan variable might be correlated with the error term, an instrumental variable for this variable needs to be constructed. This instrumental variable should not be correlated with the error term, but should be correlated with the proportion of high-leverage loans. We can construct this instrumental variable fitting a regression of the proportion of high-leverage loans on all the independent variables in the original model excluding the endogenous racial segregation index, but including some instruments that are highly correlated with the proportion of high-leverage loans. The racial segregation index is excluded to remove the endogeneity problem, and the instruments are included to account for the proportion of high-leverage loans. Thus, the instruments should be uncorrelated with the error term, but highly correlated with the proportion of high-leverage loans. The second condition can be easily tested by regressing the proportion of high-leverage loans on instruments and all explanatory variables in the original models. However, the first condition cannot be tested in case of a single instrument, but can be tested in the case of multiple instruments. After the instrumental variable is constructed, this variable is used as an independent variable in the original model to obtain unbiased estimates of parameters.

To address this simultaneity, the model is estimated by an instrumental variable estimation using 2-stage least squares (2SLS) with the following instruments: the strength of enforcement measure of the state-level anti-predatory laws and whether a state's most commonly used foreclosure process is judicial or non-judicial. The strength of a state's anti-predatory law, more specifically the strength of enforcement, is positively

correlated with the proportion of higher-priced loans because more enforcement can stimulate the market if borrowers believe that the law will eliminate the predatory behavior of lenders (Bostic, et al., 2008). Bostic and his colleagues found evidence of this in the 2005 HMDA data. The speed of foreclosure, which is largely determined by state regulation, is correlated with the share of higher-priced loans because fast foreclosure processes can reduce the lender's associated costs (Apgar, Bendimerad, & Essene, 2007). Generally, a judicial foreclosure process is slower and less easy for the lender (Immergluck, 2010). These two instruments are expected not to be directly related to racial segregation because these laws are not enacted to respond to or motivated by the racial segregation, but to protect general mortgage borrowers. It is difficult to point out the independent impact on racial segregation except through the proportion of subprime loans or high-leverage loans and other metropolitan socioeconomic variables. Since the number of instruments is greater than that of the endogenous variables, the orthogonality assumption of instruments will be tested using the Sargan (1958) and Basmann (1960) tests.

Another approach for addressing possible endogeneity from the unobserved, time-invariant effects on racial/ethnic segregation relies on the availability of a panel dataset. A fixed-effects model estimates parameters with time-demeaned or within-transformed data, which is the data subtracted by the time average of the entity (a metropolitan area in our case). Through the within-transformation method, any unobserved, time-invariant effects are eliminated, and the estimation is done by OLS or 2SLS with transformed data. It should be noted that the fixed-effects model, alone, does not correct for the simultaneity problem of time-varying variables. It only corrects the bias from omitted

time-constant variables. To address the simultaneity problem, the following model is estimated by 2SLS:

$$S\ddot{E}G_{it} = \alpha_0 + \beta'\ddot{x}_{it} + \gamma\ddot{z}_{it} + year_{2006} + year_{2007} + \ddot{e}_{it}$$

where the two dots over the aforementioned variables means within-transformed data and year 2006 and year 2007 are dummy variables for these years. This approach has the advantage of addressing omitted variable bias from any time-constant, unobserved variables, but has a disadvantage in that it relies only on the variable's time variation, ignoring any cross-sectional changes. The time variation is often very small, and consequently the standard errors can be large. Thus, the parameter estimates of variables with small time variation may not be precisely identified. Given substantial changes in MSA boundaries since 2005 and the limited availability of racially- or ethnically-specific variables that are consistent over time, only three annual waves of panel data are available, those for 2005, 2006 and 2007. The annual dissimilarity and isolation indices computed from annual HMDA data are also measured less precisely than those computed from the HMDA data combined over two years. Despite these disadvantages, the panel approach has the major advantage of addressing potential omitted variable bias and can provide for a robustness check to the 2005-2006 cross sectional analyses. Two instruments described in the previous paragraph cannot be used because they do not vary over time. For the panel regression, house price appreciation is used instead. Strong house price appreciation encourages lenders to originate more high-leverage loans because, even if borrowers have trouble in payments, it is more likely that that they can sell the house and prepay the loan. However, house price appreciation is not likely to

affect racial segregation. It might indirectly affect racial segregation through a white-minority income gap and the prevalence of high-leverage loans, but there is no clear reason to expect an independent effect. For illustration, figures 13 and 14 shows regional patterns of house price appreciation and home buyer segregation. The house price appreciation is generally high in metropolitan areas on the West and East Coasts, and Florida. While northeastern metropolitan areas have both high segregation and high house price appreciation, western and Florida metropolitan areas have low segregation and high house price appreciation. In other metropolitan areas, the relationship between segregation and appreciation is not so clear.

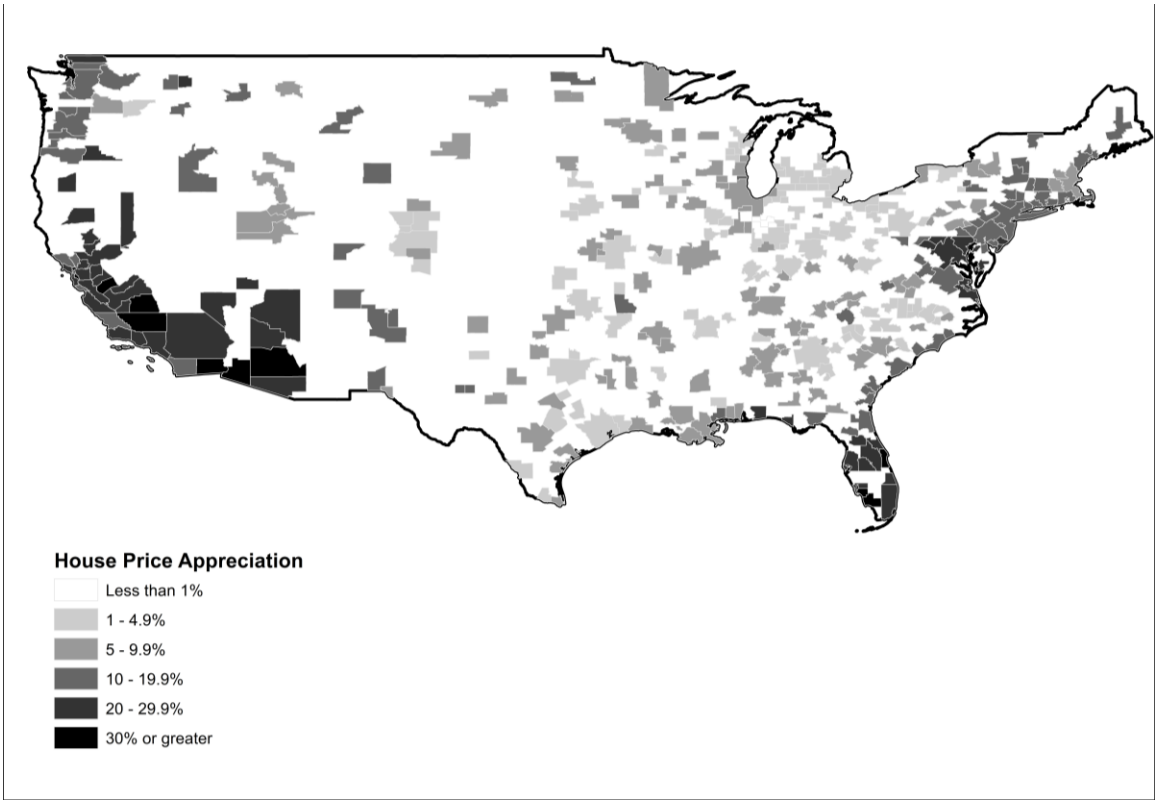

Figure 13 House Price Appreciation in 2005-2006

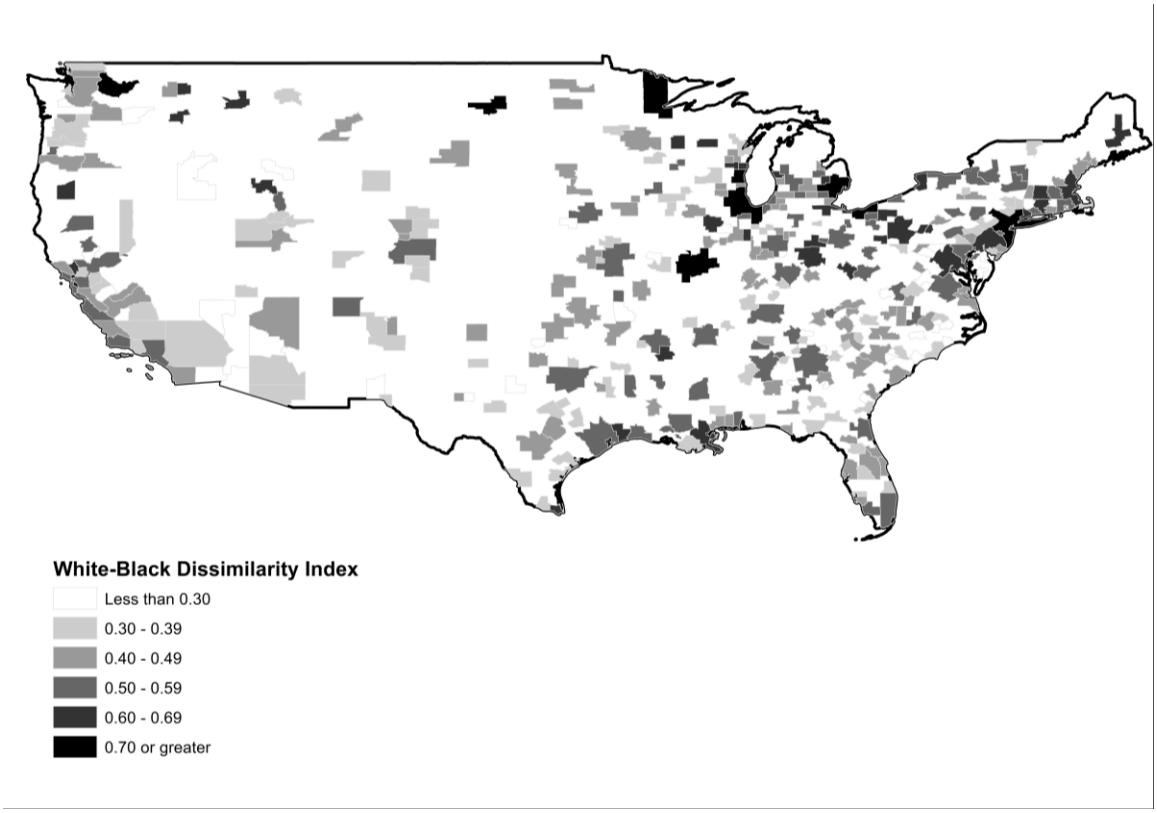

Figure 14 White-Black Dissimilarity Index in 2005 and 2006

Results of the 2005-2006 Cross Sectional Data Analysis

The four dependent variables, the black-white and Hispanic-white dissimilarity and isolation indices, are examined over three periods: the pre-Boom (1999-2000) period, the Boom (2005-2006) period, and the post-Boom period (2008-2009). The trend of the dissimilarity index shows a clear pattern as shown in Table 17 and Figures 15 and 16. The dissimilarity between non-Hispanic whites and blacks decreased from 0.496 in the pre-Boom period to 0.449 in the Boom period and increased back to 0.490 in the pre-Boom period. The dissimilarity between non-Hispanic whites and Hispanics shows a similar pattern.

The isolation index, however, does not exhibit the same patterns across black-white and Hispanic-white measurements. The isolation index of blacks steadily

decreased while that of Hispanics was the highest in the Boom period. Since the isolation index is sensitive to the proportion of the minority group's population in the MSA, I did a simple exercise of regressing the isolation index on the proportion of each minority group in a metropolitan area and examined the adjusted isolation indices, which are intercepts of the regression estimation shown in the last two rows in Table 17. These indices can be considered as the conditional mean after eliminating the influence of the proportion of the minority group. The adjusted indices show a similar pattern as in the dissimilarity index: a decrease in the Boom period and then an increase in the post-Boom period.

Table 17 The Comparison of Levels of Segregation over Three Periods

	1999-2000	2005-2006	2008-2009
Dissimilarity Index (NHW-Black)	0.496	0.449	0.490
Dissimilarity Index (NHW-Hispanic)	0.441	0.361	0.396
Isolation Index (Black)	0.165	0.160	0.143
Isolation Index (Hispanic)	0.127	0.161	0.140
Adjusted Isolation Index (Black)	0.046	0.037	0.041
Adjusted Isolation Index (Hispanic)	0.044	0.039	0.043
N = 362			

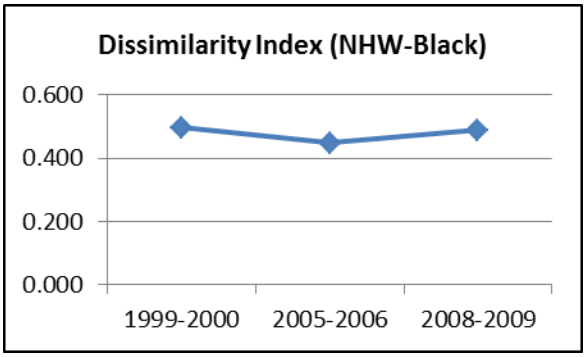

Figure 15 Trend in Dissimilarity between Non-Hispanic Whites and Blacks

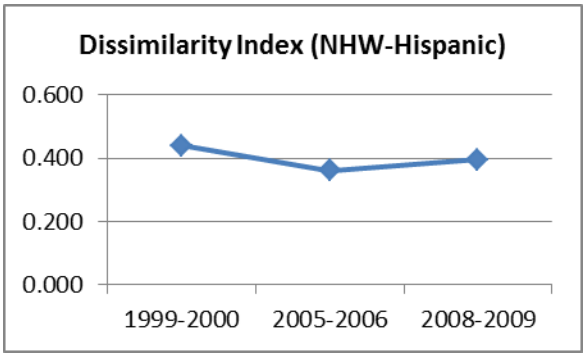

Figure 16 Trend in Dissimilarity between Non-Hispanic Whites and Hispanics

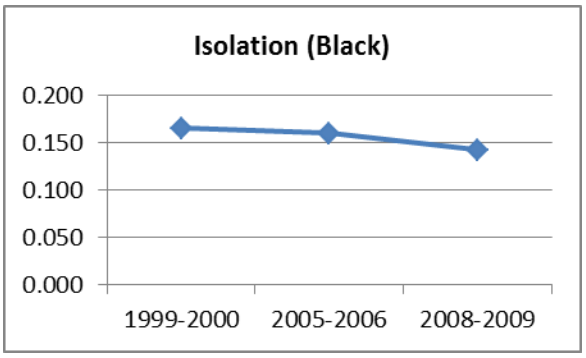

Figure 17 Trend in Black Isolation

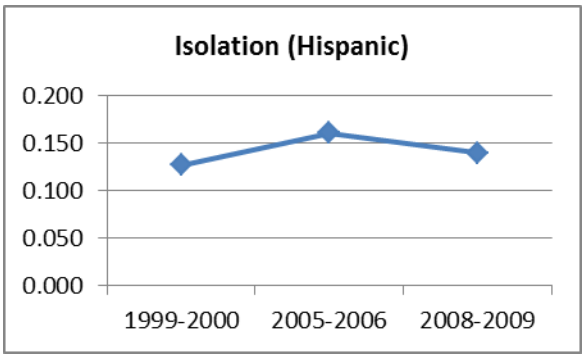

Figure 18 Trend in Hispanic Isolation

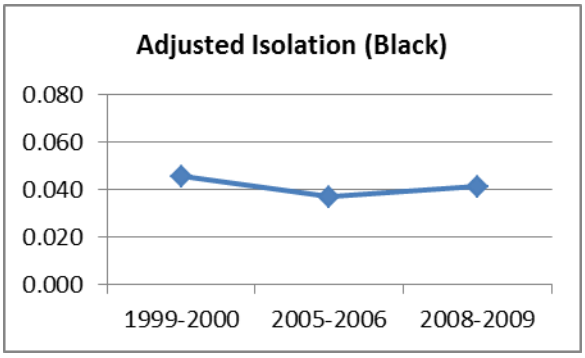

Figure 19 Tread in Black Isolation Adjusted

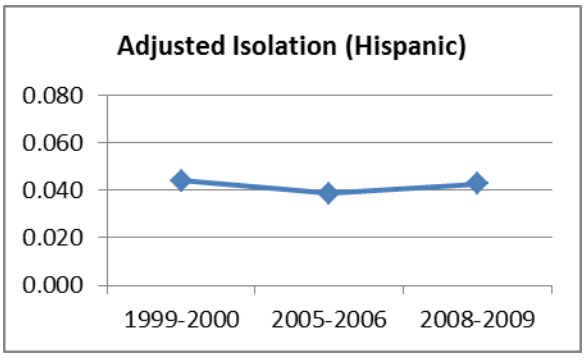

Figure 20 Trend in Hispanic Isolation Adjusted

Next, Table 18 reflects a comparison of home buyer segregation levels between two sets of homebuyers: all buyers and those using non-high-leverage loans only. The dissimilarity index reflects that the segregation level among all buyers is lower than that among those using non-high-leverage loans for both white-black and white-Hispanic dissimilarities. The pattern is different for the isolation index, where the numbers among all buyers are higher in most cases than for the non-high-leverage buyers. This result reflects the fact that the relative size of minority group is larger among all buyers than among buyers using non-high-leverage loans. Under a similar exercise, the adjusted isolation indices are examined in the last rows in Table 18. Although the general pattern

is reversed, the changes in isolation indices appear smaller than those in the dissimilarity indices. In sum, these comparisons show that the high-leverage loans in the Boom period might have helped to mitigate the segregation level, especially in terms of the dissimilarity index.

Table 18 Comparison of Segregation Level among All Loans and among Non-High-leverage Loans Only

	1999-2000		2005-2006		2008-2009	
	ALL	Non-HL Only	ALL	Non-HL Only	ALL	Non-HL Only
Dissimilarity Index (NHW-Black)	0.496	0.502	0.449	0.456	0.490	0.493
Dissimilarity Index (NHW-Hispanic)	0.441	0.447	0.361	0.365	0.396	0.399
Isolation Index (Black)	0.165	0.158	0.160	0.132	0.143	0.139
Isolation Index (Hispanic)	0.127	0.128	0.161	0.143	0.140	0.136
Adjusted Isolation Index (Black)	0.046	0.045	0.037	0.039	0.041	0.042
Adjusted Isolation Index (Hispanic)	0.044	0.046	0.039	0.039	0.043	0.042

N = 362

Descriptive statistics for all the variables used in the black-white and Hispanics-white segregation models for the 2005-2006 period are shown in Table 19 and 20 respectively. The proportion of high-leverage loans in this period is just over 20 percent for both models, reflecting the prevalence of these loans at the peak of the mortgage boom. The interracial difference in median household income is greater between non-Hispanic whites and blacks than between non-Hispanic whites and Hispanics. The difference in education level between non-Hispanics whites and Hispanics is higher than between non-Hispanic whites and blacks. But for the differences in median household income and family structure, the pattern is reversed. Both blacks and Hispanics comprise about 12.6% of the metropolitan population in the sample.

Table 19 Descriptive Statistics for Blacks Models

Variable	Mean	Std. Dev.	Min	Max
WB Dissimilarity Index	0.444	0.120	0.145	0.806
Black Isolation Index	0.197	0.158	0.008	0.639
% High-leverage Loans	0.206	0.068	0.045	0.421
% Under 45, NHW	0.575	0.050	0.386	0.772
Median Income, NHW (in thousands)	52.732	9.551	35.022	96.575
% College, NHW	0.280	0.085	0.129	0.564
WB Difference, Median Income (in thousands)	20.894	7.573	-5.097	47.610
WB Difference, % College	0.128	0.061	-0.075	0.315
WB Difference, % Married	0.230	0.071	-0.066	0.435
WB Difference, % Female Head	-0.188	0.069	-0.485	0.072
Log of Population	12.909	1.077	11.188	16.749
% Black	0.126	0.108	0.008	0.493
% Built 2000 Later	0.111	0.048	0.024	0.264
Enforcement Index	2.286	1.291	0.000	5.030
Judicial Foreclosure	0.436	0.497	0.000	1.000

N=273

Table 20 Descriptive Statistics for Hispanic Models

Variable	Mean	Std. Dev.	Min	Max
WH Dissimilarity Index	0.356	0.101	0.103	0.684
Hispanic Isolation Index	0.185	0.192	0.017	0.923
% High-leverage Loans	0.203	0.072	0.066	0.468
% Under 45, NHW	0.577	0.054	0.386	0.781
Median Income, NHW (in thousands)	53.014	9.118	36.414	96.575
% College, NHW	0.287	0.087	0.129	0.607
WH Difference, Median Income (in thousands)	15.112	7.887	-11.155	43.821
WH Difference, College	0.149	0.086	-0.086	0.448
WH Difference, Married	0.042	0.081	-0.190	0.294
WH Difference, Female Head	-0.076	0.060	-0.300	0.087
Log of Population	12.839	1.058	11.163	16.749
% Hispanic	0.126	0.159	0.009	0.947
% Built 2000 Later	0.117	0.049	0.025	0.284
% Foreign Born, Hispanic	0.350	0.140	0.031	0.647
Judicial Foreclosure	0.395	0.490	0.000	1.000

N=301

The OLS and 2SLS estimation results for NHW-black dissimilarity, black isolation, NHW-Hispanic dissimilarity, and Hispanic isolation models are reported in Tables 23 through 26 respectively. To be valid, the chosen instruments for the proportion of high-leverage loans must be highly correlated with the proportion of subprime but must be exogenous to the level of segregation. In the models for blacks, the two chosen

instruments are both individually significant in the first-stage regression, and the *F*-test statistic for joint significance is relatively large (Table 21). In Hispanic models, however, the enforcement index is not statistically significant and the *F*-test statistic is fairly small. Since a weak instrument can cause asymptotic bias, only the judicial foreclosure variable is used as an instrument for the Hispanic models. The first stage regression result of Hispanic model with the judicial foreclosure variable is reported in Table 22. In the black models, the second requirement for instrument validity is tested with the Sargan and Basmann tests of over-identification. Rejection of the null hypothesis for these tests implies that at least one instrument should not be used. As Tables 23 and 24 indicate, the test statistics are very small and we fail to reject the null hypothesis. Thus, both judicial foreclosure and the enforcement index are used as instruments in the black models, while only the judicial foreclosure variable is used in the Hispanic models, given that no apparent theoretical connection exists between judicial foreclosure and racial/ethnic segregation. In all cases, the two Hausman-type tests in tables 23 through 26 indicate that significant changes in the coefficients arise after addressing the endogeneity problem. The test statistic for the NHW-black dissimilarity model is statistically significant at around six percent, and those for the other models are significant at below five percent.

Table 21 Estimation Results of First Stage Regression of the Proportion of High-Leverage Loans for Blacks, 2005-2006 Cross Section

	Coef.	Std. Err.	t	p-value
Enforcement Index	0.005	0.003	1.990	0.047
Judicial Foreclosure	-0.032	0.007	-4.430	0.000
% Under 45, NHW	-0.402	0.070	-5.750	0.000
Median Income, NHW	0.002	0.001	2.730	0.007
% College, NHW	-0.535	0.071	-7.500	0.000
WB Difference, Median Income	0.000	0.001	0.230	0.818
WB Difference, % College	0.080	0.087	0.920	0.359
WB Difference, % Married	-0.147	0.069	-2.120	0.035
WB Difference, % Female Head	-0.081	0.064	-1.260	0.208
Log of Population	0.017	0.004	4.450	0.000
% Black	-0.005	0.032	-0.170	0.867
% Built 2000 Later	0.096	0.072	1.330	0.183
Intercept	0.276	0.063	4.390	0.000

N=	273
R-squared=	0.440
F-statistics=	10.49

Table 22 Estimation Results of First Stage Regression of the Proportion of High-Leverage Loans for Hispanics, 2005-2006 Cross Section

	Coef.	Std. Err.	t	p-value
Judicial Foreclosure	-0.015	0.006	-2.520	0.012
% Under 45, NHW	-0.217	0.058	-3.760	0.000
Median Income, NHW	0.001	0.000	1.460	0.145
% College, NHW	-0.449	0.047	-9.550	0.000
WB Difference, Median Income	0.001	0.001	1.220	0.222
WB Difference, % College	-0.062	0.053	-1.170	0.241
WB Difference, % Married	0.023	0.044	0.530	0.597
WB Difference, % Female Head	0.198	0.060	3.300	0.001
Log of Population	0.018	0.003	5.570	0.000
% Black	0.246	0.024	10.380	0.000
% Built 2000 Later	-0.050	0.063	-0.790	0.433
% Foreign Born, Hispanic	0.052	0.023	2.250	0.025
Intercept	0.163	0.053	3.080	0.002

N=	301
R-squared=	0.603
F-statistics=	6.35

Table 23 Regression Results for NHW-Black Dissimilarity Index Model

	OLS				2SLS			
	Coef.	Std. Err.	t	p-value	Coef.	Std. Err.	t	p-value
% High-leverage Loans	-0.022	0.091	-0.240	0.807	-0.609	0.358	-1.700	0.090
% Under 45, NHW	-0.310	0.111	-2.790	0.006	-0.527	0.175	-3.020	0.003
Median Income, NHW	-0.003	0.000	-2.910	0.004	-0.002	0.000	-1.300	0.194
% College, NHW	-0.008	0.120	-0.070	0.944	-0.336	0.232	-1.450	0.148
WB Difference, Median Income	0.003	0.000	2.540	0.012	0.003	0.000	2.350	0.020
WB Difference, % College	0.100	0.132	0.760	0.450	0.160	0.146	1.100	0.274
WB Difference, % Married	0.130	0.106	1.230	0.221	0.052	0.123	0.420	0.673
WB Difference, % Female Head	-0.057	0.092	-0.620	0.534	-0.049	0.099	-0.490	0.626
Log of Population	0.057	0.006	9.220	0.000	0.067	0.009	7.460	0.000
% Black	0.112	0.048	2.330	0.021	0.125	0.052	2.390	0.018
% Built 2000 Later	-1.109	0.110	-10.110	0.000	-1.032	0.127	-8.160	0.000
Intercept	0.024	0.098	0.240	0.809	0.171	0.136	1.250	0.211
N	273				273			
R-squared	0.585				N/A			
F-stat for instruments significance	N/A				10.490			
Sargan N*R-sq test stat	N/A				0.678			
Basmann test stat	N/A				0.643			
Wu-Hausman F test stat	N/A				3.388			
Durbin-Wu-Hausman chi-sq test stat	N/A				3.512			

Table 24 Regression Results for Black Isolation Index Model

	OLS				2SLS			
	Coef.	Std. Err.	t	p-value	Coef.	Std. Err.	t	p-value
% High-leverage Loans	0.012	0.078	0.150	0.880	-0.774	0.337	-2.300	0.022
% Under 45, NHW	0.010	0.095	0.100	0.918	-0.280	0.164	-1.710	0.089
Median Income, NHW	0.000	0.000	-0.560	0.575	0.001	0.000	0.950	0.343
% College, NHW	-0.019	0.103	-0.190	0.853	-0.458	0.218	-2.100	0.036
WB Difference, Median Income	0.000	0.000	0.290	0.769	0.000	0.000	0.230	0.815
WB Difference, College	-0.134	0.113	-1.180	0.239	-0.052	0.137	-0.380	0.706
WB Difference, Married	0.057	0.091	0.620	0.534	-0.048	0.116	-0.410	0.679
WB Difference, Female Head	-0.132	0.079	-1.660	0.098	-0.120	0.093	-1.280	0.202
Log of Population	0.056	0.005	10.450	0.000	0.069	0.008	8.180	0.000
% Black	1.188	0.041	28.730	0.000	1.205	0.049	24.470	0.000
% Built 2000 Later	-0.624	0.094	-6.630	0.000	-0.521	0.119	-4.380	0.000
Intercept	-0.607	0.084	-7.250	0.000	-0.410	0.128	-3.210	0.001
N	273				273			
R-squared	0.824				N/A			
F-stat for instruments significance	N/A				10.490			
Sargan N*R-sq test stat	N/A				0.009			
Basmann test stat	N/A				0.009			
Wu-Hausman F test stat	N/A				8.398			
Durbin-Wu-Hausman chi-sq test stat	N/A				8.542			

Table 25 Regression Results for NHW-Hispanic Dissimilarity Index Model

	OLS				2SLS			
	Coef.	Std. Err.	t	p-value	Coef.	Std. Err.	t	p-value
% High-leverage Loans	0.093	0.089	1.050	0.293	-1.675	0.932	-1.800	0.073
% Under 45, NHW	-0.097	0.087	-1.110	0.269	-0.424	0.217	-1.950	0.052
Median Income, NHW	0.000	0.000	-0.280	0.782	0.001	0.000	0.900	0.369
% College, NHW	-0.130	0.082	-1.580	0.116	-0.941	0.442	-2.130	0.034
WH Difference, Median Income	0.002	0.000	2.230	0.027	0.003	0.000	1.990	0.047
WH Difference, College	0.206	0.080	2.570	0.011	0.128	0.130	0.990	0.324
WH Difference, Married	-0.020	0.067	-0.290	0.769	0.023	0.106	0.210	0.831
WH Difference, Female Head	-0.359	0.093	-3.870	0.000	-0.021	0.227	-0.090	0.927
Log of Population	0.034	0.005	6.500	0.000	0.065	0.018	3.580	0.000
% Hispanic	-0.018	0.042	-0.420	0.676	0.440	0.247	1.780	0.076
% Built 2000 Later	-0.754	0.096	-7.830	0.000	-0.825	0.153	-5.390	0.000
% Foreign Born	0.135	0.035	3.840	0.000	0.235	0.075	3.120	0.002
Intercept	-0.035	0.080	-0.430	0.665	0.207	0.176	1.180	0.241
N	301				301			
R-squared	0.533				N/A			
F-stat for instruments significance	N/A				6.350			
Wu-Hausman F test stat	N/A				9.002			
Durbin-Wu-Hausman chi-sq test stat	N/A				9.154			

Table 26 Regression Results for Hispanic Isolation Index Model

	OLS				2SLS			
	Coef.	Std. Err.	t	p-value	Coef.	Std. Err.	t	p-value
% High-leverage Loans	0.223	0.085	2.630	0.009	-0.991	0.755	-1.310	0.191
% Under 45, NHW	-0.073	0.083	-0.880	0.381	-0.298	0.176	-1.690	0.092
Median Income, NHW	0.004	0.001	4.960	0.000	0.005	0.001	4.060	0.000
% College, NHW	-0.280	0.078	-3.560	0.000	-0.837	0.358	-2.340	0.020
WH Difference, Median Income	0.000	0.001	-0.190	0.851	0.000	0.001	0.400	0.692
WH Difference, College	0.081	0.076	1.060	0.292	0.027	0.105	0.260	0.794
WH Difference, Married	-0.244	0.064	-3.800	0.000	-0.215	0.086	-2.500	0.013
WH Difference, Female Head	-0.418	0.089	-4.710	0.000	-0.186	0.184	-1.010	0.314
Log of Population	0.019	0.005	3.850	0.000	0.041	0.015	2.760	0.006
% Hispanic	0.913	0.040	22.680	0.000	1.227	0.200	6.120	0.000
% Built 2000 Later	-0.215	0.092	-2.340	0.020	-0.264	0.124	-2.130	0.034
% Foreign Born	0.138	0.034	4.120	0.000	0.207	0.061	3.390	0.001
Intercept	-0.339	0.076	-4.440	0.000	-0.173	0.143	-1.210	0.226
N	301				301			
R-squared	0.882				N/A			
F-stat for instruments significance	N/A				6.350			
Wu-Hausman F test stat	N/A				4.571			
Durbin-Wu-Hausman chi-sq test stat	N/A				4.719			

I first discuss the results for control variables in the 2SLS estimations. Among the proxy variables for non-Hispanic whites' preference and discrimination, the proportion of non-Hispanic persons younger than 45 is statistically significant (at below 0.10) and negative in all models. The effect is more significant in the dissimilarity models than in the isolation models. The effects are significant at the 0.003 and 0.052 levels in the NHW-black and NHW-Hispanic dissimilarity models, and at 0.089 and 0.092 levels in the black and Hispanic isolation models, respectively. The proportion of non-Hispanic persons over age 25 with at least a bachelor's degree is negative and statistically significant at 0.05 significance in all models except the NHW-black dissimilarity model. In the NHW-black dissimilarity model, the negative effect is statistically significant only at the 0.148 level. The median household income coefficient is positive and statistically significant at the 0.01 level in the Hispanic isolation model. Potential explanations for why Hispanics are more isolated from other groups in more affluent metropolitan areas will be addressed further below. The results together generally support the claim that younger and better educated – but not richer – non-Hispanic whites are more open to racial/ethnic residential integration.

The variables on interracial differences in socioeconomic and household characteristics are not statistically significant except in certain cases. The interracial difference in the median household income coefficient is positive and statistically significant in the dissimilarity models at the 0.05 significance level, but not in the isolation models. The interracial difference in the proportion of married-couple families variable is negative and is statistically significant in the Hispanic isolation model at the 0.013 level. Other interracial difference variables are not statistically significant.

Other metropolitan area characteristics are statistically significant in all the 2SLS models and show the expected signs. Larger metropolitan areas and those areas with larger minority populations are more segregated. Metropolitan areas with greater portions of recently constructed houses are less segregated. Metropolitan areas with larger foreign-born populations have higher segregation levels, other things being equal.

Finally, the explanatory variable of primary interest here, the proportion of high-leverage loans, has a negative and statistically significant (at below 0.10) effect on segregation in all models except the Hispanic isolation model. The negative effect of high-leverage on segregation is significant at the 0.090, 0.022, and 0.073 levels in NHW-black dissimilarity, black isolation, and Hispanic dissimilarity 2SLS models, respectively.

Comparing the OLS and 2SLS coefficient estimates for the proportion of high-leverage loans, I find that the effect is negative in all 2SLS models, except the NHW-black dissimilarity model. This result indicates that the simultaneity causes an upward bias on the OLS estimates, and so the OLS models underestimate the effect that the proportion of high-leverage loans has on segregation, as expected. The effect of the proportion of high-leverage loans on segregation is substantial. A ten percentage point increase in the proportion of high-leverage loans in a metropolitan area is associated with 0.061, 0.077, and 0.168 decreases in NHW-black dissimilarity, black isolation, and NHW-Hispanic dissimilarity, respectively. These results reflect a substantial effect, considering the standard deviation of 0.120, 0.008 and 0.103 in these dependent variables, respectively. Also, these effects are larger than those due to a ten percentage point increase in the proportion of non-Hispanic persons younger than 45 and a $20,000 decrease in the interracial median household income gap.

In order to demonstrate the "raw" effect of a standard-deviation increase in high-leverage lending (6.8 percentage point) on homebuying patterns, I consider such an effect in three different MSAs, one with a low dissimilarity index (Phoenix-Mesa-Scottsdale, AZ at 0.34), one with a moderate dissimilarity index (Tampa-St. Petersburg-Clearwater, FL at 0.46), and one with a high dissimilarity index (San Francisco-Oakland-Freemont, CA at 0.59). Since a 100 percentage-point increase in high-leverage loans is associated with a 0.609 decrease in MSA's dissimilarity index, a 6.8 percentage point increase in high-leverage loans is expected to decrease the dissimilarity index by 0.0414. This corresponds to 4.14 percent of homebuyers moving to different neighborhoods. In the 2005-2006 period, the total number of homebuyers in Phoenix-Mesa-Scottsdale, Tampa-St. Petersburg-Clearwater, and San Francisco-Oakland-Freemont were 210,646, 107,835, and 116,966 respectively. Thus, a 6.8 percentage point increase in high-leverage loans would affect 8,721, 4,464, and 4,842 homebuyers in 2005-2006 in the Phoenix-Mesa-Scottsdale, Tampa-St. Petersburg-Clearwater, and San Francisco-Oakland-Freemont MSAs, respectively.

Results of 2005-2007 Panel Data Analysis

A similar model was estimated with three waves of annual dataset from 2005 to 2007. Despite a less precise measure of dependent variables, fixed-effects estimation has the advantage of correcting potential omitted variable bias. The fixed-effects estimation is done with within-transformed data, setting forth deviations from the time averages of the variables. Since this method does not correct the simultaneity problem of time-varying variables, such as the proportion of high-leverage loans, the estimation is done

with a 2SLS approach and an instrument reflecting house price appreciation of the previous year. The instruments used in the cross-sectional analysis could not be used because they do not change over time.

Table 27 Descriptive Statistics for Black Models, 2005-2007 Panel Data

Variable	Mean	Std. Dev.	Min	Max
WB Dissimilarity Index	0.509	0.111	0.207	0.828
Black Isolation Index	0.256	0.159	0.019	0.663
% High-leverage Loans	0.181	0.078	0.034	0.444
% Under 45, NHW	0.575	0.041	0.446	0.725
Median Income, NHW (in thousands)	55.755	10.072	37.894	100.422
% College, NHW	0.312	0.081	0.157	0.577
WB Difference, Median Income (in thousands)	22.585	7.150	-2.443	49.699
WB Difference, % College	0.144	0.060	0.011	0.330
WB Difference, % Married	0.227	0.067	-0.069	0.417
WB Difference, % Female Head	-0.196	0.053	-0.422	-0.016
Log of Population	13.648	0.995	11.541	16.750
% Black	0.135	0.094	0.011	0.454
% Built 2000 Later	0.112	0.051	0.020	0.293
Appreciation	0.068	0.077	-0.118	0.327

Number of MSAs=135
Time periods (years) =3

Descriptive statistics for all the variables used in the black and Hispanic segregation models for the annual panel data for the 2005-2007 period are shown in Table 27 and 28 respectively. The proportions of high-leverage loans in this period are about 18 percent for both models, a bit less than those in 2005-2006 period dataset, but still a substantial portion of the loans. As in the case of 2005-2006 period dataset, the interracial differences in median household income and family structure between non-Hispanic whites and Hispanics are larger than the differences between non-Hispanic whites and blacks, while the difference in education between non-Hispanic whites and Hispanics is greater. Blacks and Hispanics comprise about 14 and 17 percent of the metropolitan population, respectively, in this sample. House price appreciation is

relatively high because it includes 2005 and 2006, the peak of the housing boom. The difference in the number of observations between blacks and Hispanics is caused by the limited availability of a median household income variable for blacks.

The pooled 2SLS and fixed-effects 2SLS estimation results for NHW-black dissimilarity, black isolation, NHW-Hispanic dissimilarity, and Hispanic isolation models are reported in Table 29 through Table 32 respectively. In all models, the house price appreciation variable is statistically significant at the 0.05 significance level. Also, *F*-test statistics for the significance of house price appreciation is very large in all models except the NHW-black and black isolation models estimated by pooled OLS. Thus, all the models estimated by fixed effects 2SLS appear to employ a strong instrument. Since we have only one instrumental variable, we have to rely on the argument that no apparent causal relationship exists between house price appreciation and racial/ethnic segregation to defend the orthogonality of the instrumental variable.

Table 28 Descriptive Statistics for Hispanic Models, 2005-2007 Panel Data

Variable	Mean	Std. Dev.	Min	Max
WH Dissimilarity Index	0.415	0.101	0.170	0.700
Hispanic Isolation Index	0.262	0.195	0.032	0.871
% High-leverage Loans	0.183	0.083	0.030	0.477
% Under 45, NHW	0.571	0.049	0.397	0.781
Median Income, NHW (in thousands)	55.021	9.854	37.894	100.422
% College, NHW	0.312	0.087	0.135	0.637
WH Difference, Median Income (in thousands)	17.538	7.927	-4.206	45.544
WH Difference, College	0.180	0.088	-0.130	0.499
WH Difference, Married	0.040	0.085	-0.216	0.276
WH Difference, Female Head	-0.089	0.062	-0.334	0.060
Log of Population	13.395	1.044	11.522	16.750
% Hispanic	0.173	0.173	0.008	0.896
% Built 2000 Later	0.118	0.054	0.020	0.323
% Foreign Born, Hispanic	0.348	0.140	0.034	0.683
Appreciation	0.072	0.083	-0.135	0.327

Number of MSAs =168
Time periods (years)=3

Table 29 Regression Results for NHW-Black Dissimilarity Index Model, 2005-2007 Panel Data

	Pooled 2SLS				Fixed Effects 2SLS			
	Coef.	Std. Err.	t	P>|t|	Coef.	Std. Err.	t	P>|t|
% High-leverage Loans	-4.120	2.056	-2.000	0.046	-0.528	0.161	-3.280	0.001
% Under 45, NHW	-2.671	1.262	-2.120	0.035	0.227	0.397	0.570	0.568
Median Income, NHW	0.004	0.004	1.060	0.289	-0.002	0.001	-1.400	0.164
% College, NHW	-1.623	1.001	-1.620	0.106	-0.045	0.200	-0.220	0.822
WB Difference, Median Income	0.001	0.003	0.360	0.721	0.000	0.001	-0.310	0.753
WB Difference, % College	0.238	0.350	0.680	0.496	-0.013	0.072	-0.170	0.862
WB Difference, % Married	-0.181	0.366	-0.490	0.622	0.052	0.050	1.040	0.301
WB Difference, % Female Head	-0.489	0.314	-1.560	0.120	-0.018	0.059	-0.300	0.761
Log of Population	0.118	0.038	3.080	0.002	0.101	0.106	0.950	0.341
% Black	0.076	0.128	0.600	0.550	-0.519	0.442	-1.170	0.242
% Built 2000 Later	0.091	0.578	0.160	0.875	-0.304	0.186	-1.640	0.102
Year 2006	-0.002	0.032	-0.060	0.950	0.012	0.007	1.790	0.075
Year 2007	-0.400	0.233	-1.710	0.087	-0.011	0.018	-0.620	0.535
Intercept	1.473	0.808	1.820	0.069	-0.697	1.353	-0.520	0.606
N	405				405			
F stat for instrument significance	4.960				55.4			
Wu-Hausman F test stat	47.633				N/A			
Durbin-Wu-Hausman chi-sq test stat	44.081				N/A			
Chi-squared-stat for endogeneity test	N/A				13.39			

Table 30 Regression Results for Black Isolation Index Model, 2005-2007 Panel Data

	Pooled 2SLS				Fixed Effects 2SLS			
	Coef.	Std. Err.	t	P>|t|	Coef.	Std. Err.	t	P>|t|
% High-leverage Loans	-4.523	2.198	-2.060	0.040	-0.667	0.152	-4.390	0.000
% Under 45, NHW	-2.659	1.349	-1.970	0.049	0.033	0.375	0.090	0.930
Median Income, NHW	0.005	0.004	1.320	0.189	-0.002	0.001	-1.630	0.104
% College, NHW	-2.122	1.070	-1.980	0.048	0.025	0.189	0.130	0.893
WB Difference, Median Income	0.001	0.003	0.260	0.797	0.000	0.001	-0.450	0.650
WB Difference, % College	0.176	0.374	0.470	0.638	-0.106	0.068	-1.550	0.123
WB Difference, % Married	-0.391	0.392	-1.000	0.319	0.053	0.048	1.110	0.270
WB Difference, % Female Head	-0.487	0.335	-1.450	0.147	0.066	0.056	1.170	0.241
Log of Population	0.134	0.041	3.260	0.001	-0.058	0.100	-0.580	0.564
% Black	1.283	0.136	9.400	0.000	0.059	0.417	0.140	0.888
% Built 2000 Later	0.429	0.617	0.700	0.487	0.096	0.175	0.550	0.584
Year 2006	-0.002	0.034	-0.050	0.963	0.020	0.006	3.160	0.002
Year 2007	-0.469	0.249	-1.880	0.061	-0.045	0.017	-2.690	0.008
Intercept	1.048	0.864	1.210	0.226	1.268	1.276	0.990	0.321
N	405				405			
F stat for instrument significance	4.960				55.4			
Wu-Hausman F test stat	51.600				N/A			
Durbin-Wu-Hausman chi-sq test stat	47.323				N/A			
Chi-squared-stat for endogeneity test	N/A				64.582			

Table 31 Regression Results for NHW-Hispanic Dissimilarity Index Model, 2005-2007 Panel Data

	Pooled 2SLS				Fixed Effects 2SLS			
	Coef.	Std. Err.	t	P>|t|	Coef.	Std. Err.	t	P>|t|
% High-leverage Loans	-1.604	0.593	-2.710	0.007	-0.119	0.114	-1.040	0.297
% Under 45, NHW	-0.487	0.146	-3.330	0.001	0.695	0.322	2.160	0.032
Median Income, NHW	0.002	0.001	1.900	0.058	-0.001	0.001	-1.170	0.243
% College, NHW	-1.005	0.269	-3.740	0.000	0.182	0.134	1.360	0.174
WH Difference, Median Income	0.002	0.001	1.970	0.050	0.000	0.000	-0.370	0.711
WH Difference, % College	0.110	0.106	1.030	0.301	-0.001	0.054	-0.020	0.984
WH Difference, % Married	-0.060	0.084	-0.710	0.475	0.034	0.033	1.030	0.302
WH Difference, % Female Head	-0.236	0.114	-2.070	0.039	0.027	0.038	0.700	0.482
Log of Population	0.060	0.011	5.510	0.000	-0.190	0.077	-2.460	0.014
% Hispanic	0.254	0.134	1.900	0.058	-0.280	0.477	-0.590	0.558
% Built 2000 Later	-0.779	0.106	-7.350	0.000	0.138	0.133	1.030	0.303
% Foreign Born, Hispanic	0.241	0.061	3.920	0.000	0.007	0.044	0.170	0.869
Year 2006	0.015	0.012	1.260	0.208	0.020	0.005	3.820	0.000
Year 2007	-0.128	0.064	-1.990	0.047	0.020	0.013	1.550	0.123
Intercept	0.303	0.118	2.580	0.010	2.602	0.995	2.610	0.009
N	504				504			
F stat for instrument significance	14.860				81.460			
Wu-Hausman F test stat	18.658				N/A			
Durbin-Wu-Hausman chi-sq test stat	18.560				N/A			
Chi-squared-stat for endogeneity test	N/A				2.264			

Table 32 Regression Results for Hispanic Isolation Index Model, 2005-2007 Panel Data

	Pooled 2SLS				Fixed Effects 2SLS			
	Coef.	Std. Err.	t	P>|t|	Coef.	Std. Err.	t	P>|t|
% High-leverage Loans	1.464	0.490	2.990	0.003	0.700	0.106	6.590	0.000
% Under 45, NHW	-0.118	0.121	-0.970	0.330	0.495	0.300	1.650	0.100
Median Income, NHW	0.002	0.001	1.760	0.079	0.000	0.001	0.310	0.754
% College, NHW	0.028	0.222	0.130	0.899	0.127	0.125	1.020	0.309
WH Difference, Median Income	0.002	0.001	2.150	0.032	0.000	0.000	-0.240	0.810
WH Difference, % College	0.251	0.088	2.860	0.004	0.016	0.050	0.320	0.751
WH Difference, % Married	-0.285	0.070	-4.100	0.000	0.008	0.031	0.250	0.801
WH Difference, % Female Head	-0.515	0.094	-5.490	0.000	-0.003	0.036	-0.090	0.928
Log of Population	-0.002	0.009	-0.220	0.822	0.020	0.072	0.270	0.784
% Hispanic	0.561	0.110	5.090	0.000	-0.556	0.445	-1.250	0.212
% Built 2000 Later	-0.267	0.087	-3.050	0.002	0.440	0.124	3.540	0.000
% Foreign Born, Hispanic	0.049	0.051	0.970	0.333	-0.015	0.041	-0.370	0.709
Year 2006	0.010	0.010	1.050	0.294	0.007	0.005	1.360	0.173
Year 2007	0.131	0.053	2.460	0.014	0.047	0.012	3.860	0.000
Intercept	-0.250	0.097	-2.570	0.010	-0.437	0.928	-0.470	0.637
N	504				504			
F stat for instrument significance	14.860				81.46			
Wu-Hausman F test stat	6.397				N/A			
Durbin-Wu-Hausman chi-sq test stat	6.521				N/A			
Chi-squared-stat for endogeneity test	N/A				5.721			

The control variables are more often statistically significant in the pooled 2SLS estimates than in the fixed-effects model. Actually, most control variables are not statistically significant in the fixed-effects 2SLS estimates, a result not caused by larger standard errors, but by changes in parameter estimates. The estimates change rather radically, often with a different sign. It appears that the short-term variation in homebuyer segregation in this period is not well explained by short-term changes in these control variables, or the imprecision of the annual ACS estimates may cause these unexpected results. Previous studies typically have not been conducted in the fixed-effects models framework, and further research with more reliable data is required to examine whether the long-term effects are different from the results here.

The explanatory variable of our primary interest, the proportion of high-leverage loans have statistically significant -- at the 0.01 level, -- negative effects on segregation level in black models both in the pooled 2SLS and the fixed effects 2SLS, but not in the Hispanic models. Moreover, in the Hispanic isolation model, the variable shows a statistically significant, positive effect. After controlling for all the unobserved, time-invariant, fixed effects, it seems that the hypothesized negative effect only holds for black segregation. Hispanic isolation shows persistent positive effects from high-leverage lending in both cross-sectional analysis and panel data analysis. It might be that Hispanics have a cultural preference for isolating themselves from other groups, and the use of high-leverage loans helped them realize that preference. For blacks, the magnitude of the negative effect is comparable to the effect found in 2005-2006 cross-sectional analysis. A ten percentage point increase in the proportion of high-leverage loans in a

metropolitan area is associated with 0.053 and 0.067 decrease in dissimilarity and isolation indices, respectively.

Comparison of Cross-Sectional and Panel Analyses Results and Discussion

The proportion of high-leverage loans has a statistically significant, desegregating effect on black segregation both in the 2005-2006 cross-sectional and the 2005-2007 panel data analyses. The magnitude of the effect is substantial. A ten percentage point increase in the proportion of high-leverage loans is associated with a 0.061 decrease in dissimilarity and a 0.077 decrease in isolation indices across metropolitan areas, and this effect is associated with a 0.053 decrease in dissimilarity and a 0.067 decrease in isolation indices over time. In the case of the cross-sectional analysis, these effects are larger than a ten percentage point increase in the proportion of non-Hispanic persons younger than 45 and a $20,000 decrease in median household income gap. In the case of fixed-effects estimation, the effect on dissimilarity is larger than a ten percentage point increase in the proportion of houses built in 2000 or later, and the effect on isolation is larger than the effect of a $30,000 increase in the median household income of non-Hispanic whites.

In the case of Hispanic segregation, the results from the two analyses do not align well. The desegregating effect of the proportion of high-leverage loans on the dissimilarity index is statistically significant in the 2005-2006 cross-sectional analysis, but not in the fixed-effects estimate. Thus, these results support the hypothesis of the desegregating effect of the proportion of high-leverage loans only in a limited way. The results regarding Hispanic isolation are more troubling. In the 2005-2006 cross-sectional

analysis, the effect of the proportion of high-leverage loans is statistically not significant, but with the expected negative sign. In the fixed effects estimation, however, the effect is statistically significant and positive. Therefore, the hypothesized desegregating effect is not apparent among Hispanics. Based on the fixed-effects estimate, we can infer that in the relevant period, Hispanics used high-leverage loans to buy homes in more isolated ethnic communities. This result might be attributable to different preferences between blacks and Hispanics for neighborhood racial/ethnic composition and the larger proportion of immigrants among Hispanics. The Hispanics' preference for their own ethnic neighborhoods appears to be greater than that of blacks due to the higher rate of Hispanic immigrants and the consequent language barriers and dependence on ethnic cultural institutions (Charles, 2005). Also, in a recent analysis of 2010 Census data, a large increase in Hispanic isolation indices, in contrast to the decrease in black isolation indices, was attributed to the Hispanic population growth and immigration into mostly established ethnic enclaves (Logan & Stults, 2011). Thus, it might be argued that high-leverage loans helped both blacks and Hispanics to realize their neighborhood preference, and Hispanics' strong preference for an ethnic community or enclave results in the proportion of high-leverage loans having a segregating effect.

CHAPTER 6
SUMMARY OF RESULTS AND POLICY IMPLICATIONS

Summary of Results

This dissertation examined the impacts of high-leverage loans on homebuyers' housing demand, on the qualities of neighborhoods where homes are purchased, and on the metropolitan-level racial and ethnic segregation of homebuyers. The first two impacts were examined using the AHS data at the household level, and the last impact was examined using the HMDA and the ACS data at the metropolitan area level.

Results of the AHS data analysis show that the use of high-leverage loans increases housing demand and neighborhood quality, holding other household characteristics constant. A household that receives a loan with 0.05 higher PTI ratio is expected to consume ten percent more housing, other things being equal. Moreover, households receiving a loan with CLTV ratios between 0.85 and 0.90, between 0.90 and 0.95, between 0.95 and 1.00, and between 1.00 and 1.05 are expected to consume more housing by six to eight percent, than a household with a CLTV ratio of less than 0.85, holding other variables constant.

Regarding neighborhood quality, a household receiving a loan with a higher PTI ratio is expected to increase the probability of purchasing a home in a neighborhood with no townhouses or rowhouses, no apartment buildings, no business or institutions, no abandoned buildings, no building with bars on windows, no trash or junk, no parking lots, no roads needing repairs, high neighborhood rating, no stores within 15 minutes, and no serious neighborhood crime, holding other variables constant. Also, a household receiving a loan with a CLTV ratio higher than 0.85 is expected to increase the

probabilities of purchasing a home in a neighborhood with no apartment building, holding other variables constant. Some of CLTV ratio dummies have statistically significant effects on choosing neighborhoods with no business or institutions, no parking lots, high neighborhood ratings, and no stores within 15 minutes. After omitting PTI ratio in the models, most CLTV ratio dummies have statistically significant, positive effects on choosing neighborhoods with no apartment buildings and no townhouses or rowhouses. Also, some CLTV ratio dummies have statistically significant, positive effects on choosing neighborhoods with no business or institutions, open space, no buildings with bars on windows, no parking lots, high neighborhood rating, and no stores within 15 minutes. This change occurs because PTI ratio and CLTV ratio are closely correlated.

Most of the neighborhood quality variables for which PTI and CLTV ratios have significant effects are those evaluated by interviewers, and these variables are likely to be more objectively and consistently assessed than those evaluated by the interviewees themselves. The magnitudes of these effects are somewhat moderate. A 0.05 increase in PTI ratio is expected to increase the probability of choosing a higher-quality neighborhood by between 0.003 and 0.03, depending on the variables measuring the neighborhood quality. Loans with a CLTV ratio between 0.90 and 0.95, between 1.00 and 1.05, between 1.05 and 1.10, and greater than 1.10 are expected to increase the probability of choosing neighborhoods without apartment buildings by 0.064, 0.062, 0.133, and 0.121, relatively to loans with a CLTV ratio less than 0.85. Loans with a CLTV ratio between 0.85 and 0.90 are expected to increase the probability of choosing neighborhoods without business or institutions by 0.082. Loans with a CLTV ratio

greater than 1.10 are expected to increase the probability of choosing neighborhoods without parking lots and stores within 15 minutes by 0.115 and 0.157. If the PTI ratio variable is omitted from the model, the magnitudes of CLTV ratio dummies generally increase.

Results of the HMDA and ACS data analyses show that high-leverage loans have a negative effect on black segregation, while the effect on Hispanic segregation is somewhat ambiguous. The proportion of high-leverage loans in a metropolitan area has a statistically significant, negative effect on black segregation both in the 2005-2006 cross-sectional and the 2005-2007 annual panel data analyses. The magnitude of this negative effect on segregation is substantial compared to those of other variables. A ten percentage-point increase in the proportion of high-leverage loans is associated with a 0.061 decrease in dissimilarity and a 0.077 decrease in isolation indices, across metropolitan areas, and the same increase is associated with a 0.053 decrease in dissimilarity and a 0.067 decrease in isolation indices over time. In the cross-sectional analysis, these effects are more pronounced than those of a ten percentage point increase in the proportion of non-Hispanic persons younger than 45 and a $20,000 decrease in median household income gap among non-Hispanic whites and blacks. In the fixed-effects estimation, the effect on dissimilarity is larger than that of a ten percentage-point increase in the proportion of houses built in 2000 or later, and the effect on isolation is greater than that of the effect of a $30,000 increase in the median household income of non-Hispanic whites.

In the case of Hispanic segregation, the results of the 2005-2006 cross-sectional and 2005-2007 fixed-effects panel estimations differ. The proportion of high-leverage

loans has a negative effect on dissimilarity index between Hispanics and non-Hispanic whites in both cases, but is only statistically significant in the cross-sectional result. The results on the Hispanics' isolation index are more unexpected. In the 2005-2006 cross-sectional analysis, the effect of the proportion of high-leverage loans is statistically not significant, but with the expected negative sign. In the fixed effects estimation, the effect is a statistically significant and positive. Therefore, the hypothesized desegregating effect does not appear evident among Hispanics. Based on the fixed effects estimate, which is considered to be better way to establish the causal relationship, in the 2005-2007 period, the high-leverage loans seemed to help Hispanic borrowers to purchase homes in more isolated ethnic communities. This result might result from the difference between black and Hispanic preference for neighborhood racial/ethnic composition and the large proportion of immigrants among Hispanics. Although this can be attributed to the Hispanics' preference for ethnic enclave or community and the higher proportion of recent-immigrants in the Hispanic community, further research on the Hispanic segregation tendency is needed to confirm the causes of this result.

There are several ways to improve future research on the effect of high-leverage loans on neighborhood attainment and racial segregation. Neighborhood qualities models do not perform as well as the housing demand models in this dissertation. There are more objective measures of neighborhood qualities such income, housing unit characteristics, and other socioeconomic characteristics in the decennial census and the ACS data. The access to this data requires the permission from the regional census data centers. The estimation of similar models with census tract level neighborhood quality measures might improve the performance of neighborhood quality models. Also, access

to the industry data on loan characteristics could provide more accurate information on high-leverage loans in the segregation models, although these data are not likely to cover a large set of metropolitan areas very well or very consistently. The difference between black and Hispanic segregation models raise questions about the Hispanics' preference for neighborhood racial/ethnic composition. The research on this preference for both assimilated Hispanics and immigrant Hispanics would help us to understand whether the increasing isolation of Hispanics is caused by immigration or other factors affecting their neighborhood preferences.

Policy Implications

After the mortgage market collapse, mortgage underwriting criteria once again became more stringent. Given the high default and foreclosure rates in the market, this reaction was understandable. At the same time, stringent underwriting criteria, especially lower LTV and PTI ratios, will limit credit access for lower-income, minority households and thus limit both their opportunity to purchase homes and the choice of neighborhoods in which they can buy. More specifically, these stringent standards may reduce the opportunity to mitigate racial and ethnic segregation, which has been viewed as an undesirable spatial structure of the metropolitan housing market for a long time. Since both mortgage market stability and the potential benefits of homeownership – along with the mobility provided by the ability to purchase large homes – are important, policymakers should give careful consideration to the balance between the costs and benefits of the lower LTV and PTI ratios.

A wide variety of policy decisions being debated now and in the foreseeable

future will affect the availability of high-leverage loans. Although the FHA has insured high-leverage loans for a long time, the volume of these loans only is likely to have limited impact. Also, GSEs have purchased loans for "underserved" households and communities since the mid-1990s; now they no longer do this since the crisis. It is difficult to know the future of the mortgage finance system at this time, but the enhanced role of the government involvement in mortgage finance markets seems unlikely post-crisis long-term change owing to the past taxpayer bailout of GSEs and the recently elevated chance of bailout of the FHA. The two most direct and proximate examples are those concerning the definitions of the "qualified residential mortgage" and the "qualified mortgage," definitions that are crucial elements of major new regulatory initiatives developed in response to the foreclosure crisis.

The CFPB recently released the final rules on qualified mortgages, and supervisors of financial institutions are finalizing rules on qualified residential mortgages to require mortgage lenders to consider consumers' ability to repay their home loans at the time of origination. If lenders follow the rules on qualified mortgages, they can argue that they considered the consumers' ability to repay in any future lawsuits. While the rules on qualified mortgages are applied to all residential mortgages, the rules on qualified residential mortgages are applied only to privately-securitized residential mortgages. The loans meeting the standards for qualified residential mortgages are exempted from the requirements for securitizers of asset-backed securities to retain not less than five percent of the credit risk of the assets collateralizing the ABS. Thus, the cost of providing qualified residential mortgages through private securitization will be lower than other types of mortgages. Policymakers, industry, and affordable housing

advocates are all concerned about the ability of these rules to balance the goals of reducing default risk and of providing credit to a wider range of households.

The rules on qualified mortgages are aimed at restricting predatory or default risk-inducing features without benefiting borrowers. In the final rules, stated-income and/or stated-assets loans cannot be considered qualified mortgages and loans with negative amortization, interest-only payments, balloon payments, or terms more than 30 years generally cannot be qualified mortgages. These rules require that the monthly payments should be calculated on the highest payment in the first five years and that total payment-to-income or back-end debt-to-income ratio should not be more than 43 percent, which is neither too restrictive nor too lenient. The qualified mortgage rules appear to reasonably restrict the risks without excessively excluding low-income, minority borrowers. The proposed rules on qualified residential mortgages, however, include more stringent criteria on PTI and LTV: a PTI ratio and total debt-to-income ratio not more than 28 and 36 percent respectively, and a LTV ratio not more than 80 percent. If these rules are finalized, the flow of mortgage capital to low-income and/or wealth-constrained, minority borrowers is likely to be restricted, and consequently the opportunities for homeownership, access to better neighborhoods, and reduced racial/ethnic segregation are also likely to be restricted.

These rules are opposed by both industry advocates and affordable housing advocates. Holtz-Eakin et al. (2012), who represent a conservative, right-leaning perspective, argue that the tight rules may undermine mortgage finance and housing markets, and consequently the U.S. economy. They examined the impact of the combination of qualified mortgages, qualified residential mortgages, and Basel III rules

on the mortgage and housing markets and estimated about a 14 to 20 percent reduction in mortgage originations and a 9 to 13 percent reduction in home sales due to the stringent criteria. Quercia et al. (2012), with the more left-leaning Center for Community Capital, argue that the stricter rules on qualified residential mortgages on top of the rules on qualified mortgages will not provide sufficient benefits of reduced default risk to justify the reduced access to affordable mortgage credits. They examined reduced defaults, reduced foreclosures, and borrowers excluded under qualified residential mortgages rules in light of industry data. They found that the 80 percent LTV requirement in addition to the qualified mortgage rules would exclude ten otherwise performing loans to prevent one foreclosure. Similarly, they found that a 36% total debt-to-income ratio would exclude ten otherwise performing loans to prevent one foreclosure. In addition, the combination of an LTV ratio of 80 and a total debt-to-income ratio of 30 would exclude, respectively, about 93 and 91 percent of black and Hispanic borrowers with performing loans. Thus, these two studies coming from opposing ideological backgrounds express similar concerns about the stringent LTV and PTI ratios of the qualified residential mortgages rules.

The results of this dissertation suggest that policymakers should consider the impacts of regulations effecting allowable LTV and PTI ratios on borrowers' residential choices and urban form, as well as on default risk. The qualified mortgage rules are likely to restrict most predatory features of past subprime loans, but the more careful approach taken by lenders, affordable housing advocates, and various levels of governments strengthen the argument for less stringent underwriting criteria.

One in-depth study of a large, national affordable mortgage program suggests

valuable lessons. Quercia and his colleagues (2011) compared the performance of community reinvestment mortgages with that of subprime mortgages among similarly situated borrowers. The community reinvestment mortgages in the study share the same high LTV ratios as subprime loans, but contain different product features. Notably, these loans do not include predatory features such as prepayment penalties, balloon payments, or adjustable interest rates. They found that responsibly originated loans with the same high LTV ratios performed substantially better than subprime loans. The default rates of these community reinvestment mortgages were not only lower than those of subprime loans, but also lower than those of prime loans with adjustable interest rates. The performance of this high-leverage, community reinvestment loans can be attributed to the use of a 30-year, fixed-rate mortgage without complicated, predatory features, as well as the use of pre-purchase counseling, reserves, the avoidance of mortgage brokers whose incentives are tied to the volume and interest-rate of the loans, and responsive servicing when borrowers encounter repayment difficulties. Thus, in addition to the final rules on originating qualified mortgages, regulations should also govern the participating agents in the mortgage origination and service process, such as mortgage brokers and loan servicers. Further, the response to the subprime crisis should not have the result of discouraging the various small mortgage assistance or service programs of local governments, housing finance agencies, and nonprofit organizations.

Local governments, together with non-profit organizations, have supported low- and moderate-income homebuyers through low-interest mortgages, down payment subsidies, and home purchase counseling. These efforts have funded by federal block grants such as Community Development Block Grant (CDBG) and HOME investment

partnership program (HOME), state tax-exempt bond financing and state or local housing trust funds. However, most local government housing programs are eligible residents who purchase a home within that locality. If the locality is already highly racially-segregated, this programs' effect on racial segregation would be minimal. Thus, regional approaches for home purchase assistance should be encouraged. If metropolitan area level coordination is difficult to achieve, at least county level coordination would be beneficial. Even if a regional approach is pursued, the appropriate, affordable housing units should be available in the white-dominant localities. Thus, the barrier of exclusionary zoning also should be overcome.

Community Development Financial Institutions (CDFI) can provide home purchase program across jurisdiction if funds come from state or other non-local sources. The case of the Self-Help Credit Union in North Carolina can demonstrate how a CDFI can implement a fairly large-scale home purchase program using high-leverage loans in a responsible manner (Quercia, et al., 2011). First, Self-Help purchased high-leverage loans to low- and moderate-income families from Wachovia Bank. Confirming the good performance of these loans, they started a loan guarantee program funded by the Ford Foundation with help of Fannie Mae. Owing to this guarantee, Fannie Mae purchased and securitized their high-leverage loans and sold these securities or held them in its portfolio. The result was good loan performance and homeownership for 46,000 families. Even if other CDFIs cannot follow this model, demonstrating good performance of high-leverage loans to low- and moderate-income families with careful underwriting practices and homeowner counseling will help these kinds of loans to be more acceptable and sustainable. Thus, all levels of governments and non-profit

institutions, with the cooperation among them, can help low- and moderate-income, minority families move to better neighborhoods and live in less segregated environments.

So far, the potential impact of mortgage finance on metropolitan areas' spatial pattern such as racial segregation has been mentioned neither in the debate on specific rule making nor that on the future of mortgage markets. Since a majority of households should rely on mortgages to buy homes, it is not difficult to think that the mortgage market change affect the spatial patterns. The most well-known example of this impact would probably be the FHA's role in contributing suburbanization and racial segregation (Immergluck, 2004; Jackson, 1987; Massey & Denton, 1993). The preference of the FHA, a major mortgage insurer at the time, for new purchase loans of single-family houses in newer, large scale, suburban developments is often attributed to encourage suburbanization and facilitate decline of inner city neighborhoods. They did not intend to facilitate the specific form of metropolitan areas, but just provided the insurances for loans in places where they judge to be safer. Now, knowing the impact of mortgage market policy and industry practice on the metropolitan structure in the past, we should consider not only financial market stability but also non-spatial impact on minority homeownership and access to higher quality neighborhoods and spatial impact on racial segregation.

Appendix A Estimation Results of Logit Models on Neighborhood Qualities

Table 33 Model of No Townhouses or Rowhouses

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-3.717	-	-	1.431	0.2317	0.179	-	-	0.004	0.9527
LN_ZINC_07	0.760	2.137	0.103	30.706	<.0001	0.183	1.201	0.025	3.288	0.0698
LN_HP_07	-0.750	0.472	-0.101	1.712	0.1907	-0.246	0.782	-0.034	0.192	0.6616
PER	0.229	1.257	0.031	22.380	<.0001	0.265	1.303	0.037	30.518	<.0001
HHAGE	0.001	1.001	0.000	0.033	0.8566	0.002	1.002	0.000	0.149	0.6999
MARRIED	0.146	1.157	0.020	0.976	0.3233	0.166	1.181	0.023	1.281	0.2577
FEMALE_HEAD	-0.244	0.784	-0.035	2.661	0.1029	-0.244	0.784	-0.036	2.709	0.0998
HIGH	-0.417	0.659	-0.050	2.886	0.0894	-0.368	0.692	-0.046	2.291	0.1301
BACH	-0.686	0.503	-0.088	6.826	0.0090	-0.573	0.564	-0.075	4.896	0.0269
PGRAD	-0.672	0.510	-0.086	5.768	0.0163	-0.551	0.577	-0.072	3.981	0.0460
BLACK	0.259	1.296	0.033	1.809	0.1786	0.145	1.156	0.019	0.591	0.4421
HISPANIC	0.116	1.122	0.015	0.445	0.5046	0.108	1.114	0.015	0.399	0.5275
ASIAN	-0.609	0.544	-0.091	8.443	0.0037	-0.607	0.545	-0.092	8.554	0.0034
OTHERS	-0.945	0.389	-0.147	3.734	0.0533	-0.937	0.392	-0.148	3.809	0.0510
INTEREST_07	-0.027	0.974	-0.004	0.426	0.5141	0.011	1.011	0.001	0.070	0.7910
TERM	0.008	1.008	0.001	0.587	0.4434	0.007	1.007	0.001	0.517	0.4720
GOV	-0.120	0.887	-0.016	0.899	0.3431	-0.110	0.896	-0.015	0.765	0.3817
ARM_DUM	0.080	1.083	0.011	0.148	0.7009	0.100	1.105	0.014	0.236	0.6272
DOWNPAY_07	0.008	1.008	0.001	5.013	0.0252	0.009	1.009	0.001	6.992	0.0082
DOWNPAY_07_SQ	0.000	1.000	0.000	2.098	0.1475	0.000	1.000	0.000	4.729	0.0297
CLTV_85_90	0.280	1.323	0.038	1.549	0.2132	0.503	1.653	0.070	5.200	0.0226
CLTV_90_95	0.316	1.372	0.043	2.241	0.1344	0.550	1.733	0.076	7.127	0.0076
CLTV_95_100	0.250	1.284	0.034	1.203	0.2727	0.418	1.519	0.059	3.488	0.0618
CLTV_100_105	0.180	1.197	0.025	0.590	0.4424	0.377	1.457	0.054	2.679	0.1017
CLTV_105_110	0.462	1.586	0.061	0.871	0.3508	0.599	1.821	0.082	1.516	0.2182
CLTV_GT_110	0.813	2.255	0.100	1.981	0.1593	1.193	3.297	0.145	4.297	0.0382
PTI	4.090	59.724	0.553	40.112	<.0001					
WHEN	-0.100	0.905	-0.013	4.912	0.0267	-0.083	0.045	-0.011	3.449	0.0633
-2 Log L	2463.159					2505.387				
LR Chi	662.679	<.0001				620.450	<.0001			
Score Chi	591.145	<.0001				551.797	<.0001			
Pseudo-R2	0.307					0.290				
N	2964					2964				

Table 34 Model of No Apartment Buildings

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-4.704	-	-	2.445	0.1179	-0.661	-	-	0.052	0.8201
LN_ZINC_07	1.035	2.8150	0.140	53.295	<.0001	0.421	1.523	0.058	16.709	<.0001
LN_HP_07	-1.277	0.2790	-0.173	5.343	0.0208	-0.710	0.492	-0.098	1.742	0.1869
PER	0.144	1.1540	0.020	10.551	0.0012	0.177	1.194	0.025	16.169	<.0001
HHAGE	0.011	1.0110	0.002	5.532	0.0187	0.012	1.012	0.002	6.190	0.0128
MARRIED	0.278	1.3210	0.038	3.722	0.0537	0.317	1.372	0.044	4.924	0.0265
FEMALE_HEAD	-0.108	0.898	-0.016	0.544	0.4606	-0.116	0.891	-0.017	0.642	0.4229
HIGH	0.369	1.446	0.050	3.347	0.0673	0.429	1.536	0.061	4.624	0.0315
BACH	0.067	1.069	0.010	0.090	0.7642	0.182	1.200	0.027	0.683	0.4085
PGRAD	-0.114	0.892	-0.017	0.216	0.6420	0.021	1.021	0.003	0.008	0.9303
BLACK	0.304	1.356	0.039	2.483	0.1151	0.187	1.205	0.025	0.971	0.3244
HISPANIC	-0.112	0.894	-0.016	0.482	0.4877	-0.106	0.899	-0.015	0.440	0.5071
ASIAN	-0.282	0.754	-0.040	1.691	0.1935	-0.298	0.742	-0.044	1.922	0.1656
OTHERS	0.459	1.583	0.056	0.623	0.4299	0.430	1.537	0.054	0.568	0.4510
INTEREST_07	-0.091	0.913	-0.012	5.219	0.0223	-0.053	0.948	-0.007	1.850	0.1738
TERM	0.005	1.005	0.001	0.247	0.6191	0.004	1.004	0.001	0.147	0.7013
GOV	-0.175	0.839	-0.024	2.000	0.1573	-0.157	0.855	-0.022	1.627	0.2021
ARM_DUM	0.035	1.036	0.005	0.031	0.8606	0.057	1.059	0.008	0.083	0.7732
DOWNPAY_07	0.009	1.009	0.001	5.750	0.0165	0.010	1.010	0.001	7.786	0.0053
DOWNPAY_07_SQ	0.000	1.000	0.000	0.542	0.4617	0.000	1.000	0.000	2.074	0.1498
CLTV_85_90	0.226	1.254	0.033	1.020	0.3126	0.425	1.530	0.063	3.770	0.0522
CLTV_90_95	0.463	1.589	0.064	4.678	0.0306	0.678	1.969	0.095	10.544	0.0012
CLTV_95_100	0.250	1.284	0.036	1.222	0.2690	0.422	1.525	0.062	3.637	0.0565
CLTV_100_105	0.451	1.569	0.062	3.731	0.0534	0.632	1.882	0.090	7.688	0.0056
CLTV_105_110	1.114	3.047	0.133	4.285	0.0385	1.295	3.651	0.159	5.877	0.0153
CLTV_GT_110	0.980	2.664	0.121	3.463	0.0627	1.308	3.699	0.161	6.350	0.0117
PTI	4.134	62.426	0.561	42.204	<.0001					
WHEN	-0.081	0.922	-0.011	3.566	0.0590	-0.067	0.935	-0.009	2.472	0.1159
-2 Log L	2519.491					2564.385				
LR Chi	583.020	<.0001				538.126	<.0001			
Score Chi	540.460	<.0001				502.430	<.0001			
Pseudo-R2	0.275					0.255				
N	2979					2979				

Table 35 Model of No Business or Institutions

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-1.099	-	-	0.157	0.6922	0.835	-	-	0.095	0.7580
LN_ZINC_07	0.506	1.659	0.081	15.813	<.0001	0.222	1.249	0.036	5.467	0.0194
LN_HP_07	-0.680	0.507	-0.109	1.793	0.1806	-0.429	0.651	-0.069	0.736	0.3911
PER	0.084	1.088	0.014	4.681	0.0305	0.097	1.102	0.016	6.278	0.0122
HHAGE	0.002	1.002	0.000	0.135	0.7130	0.002	1.002	0.000	0.194	0.6595
MARRIED	0.414	1.512	0.068	9.761	0.0018	0.437	1.548	0.072	10.982	0.0009
FEMALE_HEAD	0.093	1.097	0.016	0.458	0.4985	0.092	1.096	0.016	0.448	0.5031
HIGH	0.012	1.012	0.002	0.004	0.9497	0.038	1.039	0.006	0.041	0.8395
BACH	-0.047	0.954	-0.008	0.049	0.8249	0.006	1.006	0.001	0.001	0.9783
PGRAD	0.095	1.100	0.015	0.168	0.6820	0.157	1.170	0.025	0.461	0.4970
BLACK	-0.543	0.581	-0.094	11.427	0.0007	-0.593	0.553	-0.104	13.833	0.0002
HISPANIC	-0.127	0.881	-0.020	0.695	0.4045	-0.120	0.887	-0.019	0.624	0.4297
ASIAN	-0.271	0.763	-0.045	1.570	0.2103	-0.278	0.758	-0.046	1.655	0.1982
OTHERS	0.581	1.788	0.079	1.074	0.3000	0.572	1.772	0.078	1.047	0.3062
INTEREST_07	-0.103	0.902	-0.017	8.285	0.0040	-0.086	0.917	-0.014	5.922	0.0150
TERM	0.002	1.002	0.000	0.047	0.8288	0.002	1.002	0.000	0.032	0.8581
GOV	0.038	1.039	0.006	0.111	0.7394	0.046	1.047	0.007	0.163	0.6865
ARM_DUM	0.038	1.038	0.006	0.040	0.8414	0.049	1.050	0.008	0.069	0.7935
DOWNPAY_07	0.005	1.005	0.001	1.776	0.1827	0.005	1.005	0.001	2.294	0.1299
DOWNPAY_07_SQ	0.000	1.000	0.000	0.122	0.7271	0.000	1.000	0.000	0.439	0.5079
CLTV_85_90	0.548	1.730	0.082	6.138	0.0132	0.647	1.909	0.098	8.739	0.0031
CLTV_90_95	0.214	1.239	0.035	1.198	0.2738	0.323	1.382	0.052	2.820	0.0931
CLTV_95_100	-0.002	0.998	0.000	0.000	0.9926	0.080	1.083	0.013	0.146	0.7027
CLTV_100_105	0.128	1.137	0.021	0.359	0.5493	0.212	1.236	0.035	0.998	0.3178
CLTV_105_110	0.262	1.300	0.042	0.338	0.5613	0.339	1.403	0.055	0.568	0.4509
CLTV_GT_110	0.551	1.735	0.083	1.342	0.2467	0.682	1.977	0.102	2.076	0.1496
PTI	1.949	7.025	0.313	11.356	0.0008					
WHEN	-0.065	0.937	-0.010	2.898	0.0887	-0.059	0.943	-0.009	2.344	0.1258
-2 Log L	2902.999					2914.557				
LR Chi	399.308	<.0001				387.749	<.0001			
Score Chi	362.803	<.0001				353.196	<.0001			
Pseudo-R2	0.187					0.182				
N	2980					2980				

Table 36 Model of Open Spaces

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-5.397	-	-	4.285	0.0384	-4.746	-	-	3.444	0.0635
LN_ZINC_07	0.231	1.260	0.045	4.312	0.0379	0.138	1.148	0.027	2.723	0.0989
LN_HP_07	0.314	1.369	0.061	0.438	0.5081	0.393	1.481	0.077	0.696	0.4040
PER	-0.052	0.950	-0.010	2.128	0.1447	-0.047	0.954	-0.009	1.766	0.1839
HHAGE	0.004	1.004	0.001	0.950	0.3297	0.004	1.004	0.001	1.031	0.3100
MARRIED	0.138	1.148	0.027	1.215	0.2703	0.144	1.155	0.028	1.327	0.2493
FEMALE_HEAD	0.063	1.065	0.012	0.215	0.6431	0.064	1.066	0.012	0.226	0.6343
HIGH	0.148	1.159	0.027	0.639	0.4241	0.159	1.172	0.029	0.741	0.3895
BACH	0.370	1.448	0.071	3.423	0.0643	0.390	1.477	0.075	3.827	0.0504
PGRAD	0.313	1.368	0.060	2.085	0.1487	0.336	1.399	0.064	2.414	0.1202
BLACK	-0.020	0.981	-0.004	0.015	0.9013	-0.036	0.965	-0.007	0.051	0.8212
HISPANIC	0.044	1.045	0.009	0.098	0.7546	0.047	1.048	0.009	0.111	0.7386
ASIAN	0.004	1.004	0.001	0.001	0.9823	0.005	1.005	0.001	0.001	0.9783
OTHERS	0.195	1.216	0.039	0.194	0.6598	0.196	1.217	0.039	0.196	0.6584
INTEREST_07	0.020	1.020	0.004	0.330	0.5657	0.025	1.025	0.005	0.556	0.4558
TERM	-0.011	0.989	-0.002	1.759	0.1847	-0.011	0.989	-0.002	1.866	0.1720
GOV	0.053	1.055	0.010	0.262	0.6087	0.054	1.056	0.011	0.270	0.6034
ARM_DUM	0.208	1.231	0.042	1.602	0.2056	0.212	1.236	0.042	1.666	0.1967
DOWNPAY_07	0.003	1.003	0.001	0.980	0.3222	0.003	1.003	0.001	1.182	0.2770
DOWNPAY_07_SQ	0.000	1.000	0.000	0.505	0.4773	0.000	1.000	0.000	0.741	0.3895
CLTV_85_90	0.074	1.077	0.014	0.160	0.6892	0.110	1.116	0.021	0.364	0.5464
CLTV_90_95	-0.115	0.891	-0.021	0.387	0.5341	-0.078	0.925	-0.014	0.182	0.6700
CLTV_95_100	0.242	1.274	0.047	1.537	0.2150	0.270	1.310	0.053	1.936	0.1641
CLTV_100_105	0.304	1.355	0.060	2.321	0.1277	0.335	1.399	0.066	2.875	0.0900
CLTV_105_110	-0.103	0.902	-0.019	0.056	0.8127	-0.071	0.932	-0.013	0.026	0.8709
CLTV_GT_110	0.310	1.364	0.061	0.524	0.4693	0.365	1.440	0.072	0.731	0.3925
PTI	0.676	1.966	0.132	1.621	0.2030					
WHEN	0.014	1.014	0.003	0.153	0.6959	0.016	1.016	0.003	0.211	0.6461
-2 Log L	3401.878					3403.495				
LR Chi	264.121	<.0001				262.504	<.0001			
Score Chi	239.118	0.0003				237.585	0.0003			
Pseudo-R2	0.120					0.119				
N	2978					2978				

Table 37 Model of No Abandoned Buildings

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	5.252	-	-	0.000	0.9897	7.336	-	-	0.000	0.9858
LN_ZINC_07	0.812	2.252	0.024	7.140	0.0075	0.470	1.599	0.014	4.315	0.0378
LN_HP_07	-0.086	0.918	-0.003	0.006	0.9407	0.298	1.347	0.009	0.070	0.7913
PER	0.168	1.183	0.005	3.018	0.0823	0.177	1.194	0.005	3.357	0.0669
HHAGE	0.012	1.012	0.000	1.169	0.2796	0.012	1.012	0.000	1.169	0.2796
MARRIED	0.106	1.112	0.003	0.112	0.7381	0.172	1.188	0.005	0.298	0.5850
FEMALE_HEAD	-0.016	0.984	0.000	0.003	0.9585	-0.007	0.993	0.000	0.001	0.9818
HIGH	-0.149	0.861	-0.005	0.106	0.7449	-0.095	0.910	-0.003	0.043	0.8350
BACH	0.246	1.279	0.007	0.218	0.6403	0.336	1.400	0.009	0.420	0.5172
PGRAD	-0.042	0.959	-0.001	0.006	0.9407	0.062	1.064	0.002	0.013	0.9110
BLACK	-1.439	0.237	-0.062	21.910	<.0001	-1.477	0.228	-0.065	23.704	<.0001
HISPANIC	-0.401	0.670	-0.011	1.159	0.2817	-0.403	0.668	-0.011	1.165	0.2804
ASIAN	-0.427	0.653	-0.012	0.639	0.4240	-0.451	0.637	-0.013	0.714	0.3981
OTHERS	-0.393	0.675	-0.011	0.129	0.7200	-0.393	0.675	-0.011	0.129	0.7190
INTEREST_07	-0.168	0.845	-0.005	5.470	0.0193	-0.156	0.855	-0.005	4.764	0.0291
TERM	0.039	1.039	0.001	4.191	0.0407	0.036	1.036	0.001	3.625	0.0569
GOV	0.197	1.217	0.006	0.543	0.4611	0.215	1.240	0.006	0.654	0.4188
ARM_DUM	-0.489	0.613	-0.017	1.629	0.2018	-0.479	0.619	-0.017	1.572	0.2100
DOWNPAY_07	0.007	1.007	0.000	0.706	0.4008	0.007	1.007	0.000	0.732	0.3922
DOWNPAY_07_SQ	0.000	1.000	0.000	0.093	0.7605	0.000	1.000	0.000	0.144	0.7047
CLTV_85_90	0.924	2.519	0.022	2.439	0.1184	1.009	2.743	0.025	2.942	0.0863
CLTV_90_95	0.041	1.042	0.001	0.009	0.9251	0.166	1.181	0.006	0.147	0.7010
CLTV_95_100	-0.013	0.987	0.000	0.001	0.9767	0.063	1.065	0.002	0.019	0.8893
CLTV_100_105	0.384	1.468	0.011	0.690	0.4060	0.437	1.548	0.013	0.900	0.3428
CLTV_105_110	-0.209	0.811	-0.008	0.046	0.8299	-0.138	0.871	-0.005	0.020	0.8868
CLTV_GT_110	0.048	1.050	0.002	0.003	0.9592	0.155	1.167	0.005	0.027	0.8699
PTI	2.230	9.295	0.067	2.788	0.0950					
WHEN	-0.099	0.906	-0.003	1.574	0.2096	-0.098	0.907	-0.003	1.556	0.2123
-2 Log L	693.700					696.563				
LR Chi	201.244	0.0408				198.381	0.0489			
Score Chi	211.940	0.0122				209.497	0.0143			
Pseudo-R2	0.252					0.248				
N	2971					2971				

Table 38 Model of No Buildings with Bars on Windows

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	8.305	-	-	0.000	0.9823	10.668	-	-	0.001	0.9788
LN_ZINC_07	0.652	1.920	0.043	10.150	0.0014	0.329	1.389	0.022	4.816	0.0282
LN_HP_07	-0.022	0.979	-0.001	0.001	0.9775	0.280	1.323	0.019	0.139	0.7097
PER	-0.041	0.960	-0.003	0.549	0.4587	-0.028	0.972	-0.002	0.267	0.6057
HHAGE	0.000	1.000	0.000	0.002	0.9685	0.000	1.000	0.000	0.001	0.9801
MARRIED	0.121	1.128	0.008	0.327	0.5674	0.169	1.184	0.012	0.653	0.4189
FEMALE_HEAD	0.108	1.114	0.007	0.218	0.6403	0.112	1.118	0.008	0.234	0.6286
HIGH	0.097	1.102	0.006	0.122	0.7267	0.130	1.139	0.009	0.221	0.6385
BACH	0.044	1.045	0.003	0.018	0.8929	0.095	1.099	0.006	0.086	0.7695
PGRAD	-0.437	0.646	-0.032	1.578	0.2091	-0.369	0.691	-0.028	1.143	0.2850
BLACK	-0.660	0.517	-0.051	6.908	0.0086	-0.681	0.506	-0.053	7.430	0.0064
HISPANIC	0.075	1.078	0.005	0.119	0.7305	0.073	1.076	0.005	0.114	0.7352
ASIAN	0.182	1.199	0.011	0.287	0.5921	0.142	1.152	0.009	0.177	0.6743
OTHERS	-0.733	0.480	-0.057	0.963	0.3264	-0.717	0.488	-0.056	0.932	0.3344
INTEREST_07	-0.112	0.894	-0.007	4.360	0.0368	-0.097	0.908	-0.006	3.304	0.0691
TERM	-0.002	0.998	-0.000	0.016	0.9010	-0.004	0.996	0.000	0.059	0.8088
GOV	-0.029	0.972	-0.002	0.025	0.8740	-0.029	0.971	-0.002	0.026	0.8732
ARM_DUM	0.046	1.047	0.003	0.027	0.8708	0.049	1.050	0.003	0.030	0.8631
DOWNPAY_07	0.004	1.004	0.000	0.524	0.4692	0.004	1.004	0.000	0.493	0.4827
DOWNPAY_07_SQ	0.000	1.000	0.000	0.010	0.9206	0.000	1.000	0.000	0.000	0.9897
CLTV_85_90	0.557	1.745	0.033	2.287	0.1305	0.665	1.945	0.040	3.324	0.0683
CLTV_90_95	0.497	1.644	0.030	2.270	0.1319	0.603	1.827	0.037	3.407	0.0649
CLTV_95_100	0.121	1.129	0.008	0.125	0.7242	0.202	1.224	0.014	0.352	0.5532
CLTV_100_105	-0.088	0.916	-0.006	0.068	0.7937	-0.015	0.985	-0.001	0.002	0.9638
CLTV_105_110	-0.645	0.525	-0.053	0.992	0.3192	-0.541	0.582	-0.044	0.704	0.4014
CLTV_GT_110	-0.193	0.824	-0.014	0.084	0.7721	-0.098	0.907	-0.007	0.022	0.8832
PTI	2.121	8.340	0.141	5.415	0.0200					
WHEN	-0.116	0.890	-0.008	3.026	0.0820	-0.112	0.894	-0.007	2.846	0.0916
-2 Log L	1279.217					1284.73				
LR Chi	468.989	<.0001				463.47	<.0001			
Score Chi	514.585	<.0001				511.42	<.0001			
Pseudo-R2	0.330					0.33				
N	2890					2890				

Table 39 Model of No Trash or Junk

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-5.194	-	-	1.218	0.2697	-3.069	-	-	0.450	0.5024
LN_ZINC_07	0.689	1.992	0.040	10.015	0.0016	0.380	1.462	0.022	5.531	0.0187
LN_HP_07	-0.158	0.854	-0.009	0.033	0.8557	0.123	1.131	0.007	0.021	0.8853
PER	0.005	1.005	0.000	0.007	0.9315	0.018	1.018	0.001	0.093	0.7600
HHAGE	0.009	1.009	0.001	1.407	0.2356	0.009	1.009	0.001	1.477	0.2242
MARRIED	0.283	1.327	0.017	1.615	0.2038	0.322	1.380	0.019	2.106	0.1467
FEMALE_HEAD	-0.009	0.991	-0.001	0.002	0.9666	-0.003	0.997	0.000	0.000	0.9881
HIGH	-0.088	0.916	-0.005	0.080	0.7768	-0.071	0.931	-0.004	0.053	0.8177
BACH	0.126	1.135	0.007	0.127	0.7213	0.167	1.182	0.009	0.225	0.6354
PGRAD	-0.055	0.946	-0.003	0.021	0.8861	0.004	1.004	0.000	0.000	0.9911
BLACK	-0.289	0.749	-0.019	1.244	0.2647	-0.347	0.707	-0.023	1.826	0.1766
HISPANIC	0.150	1.162	0.008	0.350	0.5540	0.156	1.169	0.009	0.380	0.5374
ASIAN	0.217	1.242	0.012	0.286	0.5926	0.198	1.219	0.011	0.239	0.6251
OTHERS	0.769	2.157	0.034	0.477	0.4896	0.762	2.141	0.034	0.470	0.4932
INTEREST_07	-0.026	0.974	-0.002	0.198	0.6563	-0.011	0.989	-0.001	0.033	0.8558
TERM	0.010	1.010	0.001	0.359	0.5491	0.008	1.008	0.000	0.234	0.6287
GOV	0.029	1.029	0.002	0.023	0.8786	0.035	1.036	0.002	0.036	0.8494
ARM_DUM	-0.182	0.833	-0.011	0.396	0.5294	-0.184	0.832	-0.011	0.406	0.5239
DOWNPAY_07	-0.007	0.993	0.000	0.938	0.3327	-0.006	0.994	0.000	0.756	0.3847
DOWNPAY_07_SQ	0.000	1.000	0.000	1.812	0.1783	0.000	1.000	0.000	1.418	0.2338
CLTV_85_90	0.029	1.029	0.001	0.005	0.9417	0.133	1.142	0.006	0.118	0.7308
CLTV_90_95	-0.003	0.997	0.000	0.000	0.9927	0.109	1.115	0.005	0.092	0.7620
CLTV_95_100	-0.755	0.470	-0.046	4.171	0.0411	-0.671	0.511	-0.041	3.359	0.0668
CLTV_100_105	-0.685	0.504	-0.040	3.171	0.0750	-0.596	0.551	-0.036	2.450	0.1175
CLTV_105_110	-0.937	0.392	-0.061	1.742	0.1869	-0.859	0.424	-0.057	1.469	0.2255
CLTV_GT_110	-1.124	0.325	-0.079	2.154	0.1422	-0.998	0.369	-0.070	1.699	0.1925
PTI	2.106	8.218	0.122	4.460	0.0347					
WHEN	0.067	1.069	0.004	0.998	0.3179	0.073	1.076	0.004	1.203	0.2728
-2 Log L	1262.000						1266.571			
LR Chi	204.672	0.0283					200.101	0.0410		
Score Chi	190.417	0.1134					186.338	0.1455		
Pseudo-R2	0.171						0.167			
N	2979						2979			

Table 40 Model of No Parking Lots

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-7.595	-	-	6.369	0.0116	-3.618	-	-	1.548	0.2135
LN_ZINC_07	0.865	2.375	0.122	39.808	<.0001	0.301	1.351	0.043	8.847	0.0029
LN_HP_07	-0.224	0.799	-0.032	0.170	0.6799	0.236	1.266	0.034	0.196	0.6581
PER	0.181	1.198	0.026	15.471	<.0001	0.212	1.236	0.030	21.417	<.0001
HHAGE	0.006	1.006	0.001	1.686	0.1941	0.007	1.007	0.001	1.971	0.1604
MARRIED	0.271	1.311	0.039	3.687	0.0548	0.305	1.357	0.045	4.760	0.0291
FEMALE_HEAD	0.027	1.027	0.004	0.035	0.8517	0.026	1.027	0.004	0.035	0.8519
HIGH	-0.140	0.869	-0.018	0.390	0.5321	-0.061	0.941	-0.008	0.076	0.7835
BACH	-0.345	0.708	-0.047	2.002	0.1571	-0.218	0.804	-0.031	0.820	0.3651
PGRAD	-0.486	0.615	-0.069	3.448	0.0633	-0.331	0.718	-0.048	1.659	0.1978
BLACK	0.287	1.332	0.038	2.344	0.1258	0.167	1.182	0.023	0.825	0.3637
HISPANIC	0.021	1.021	0.003	0.015	0.9012	0.034	1.035	0.005	0.042	0.8378
ASIAN	-0.324	0.723	-0.049	2.204	0.1377	-0.324	0.724	-0.050	2.229	0.1355
OTHERS	-0.361	0.697	-0.055	0.521	0.4703	-0.366	0.694	-0.057	0.544	0.4609
INTEREST_07	-0.059	0.943	-0.008	2.398	0.1215	-0.026	0.974	-0.004	0.482	0.4874
TERM	0.007	1.007	0.001	0.554	0.4567	0.007	1.007	0.001	0.471	0.4923
GOV	0.095	1.100	0.013	0.592	0.4416	0.111	1.118	0.016	0.819	0.3654
ARM_DUM	0.010	1.010	0.001	0.003	0.9600	0.025	1.025	0.004	0.016	0.8986
DOWNPAY_07	0.005	1.005	0.001	1.843	0.1746	0.008	1.008	0.001	3.982	0.0460
DOWNPAY_07_SQ	0.000	1.000	0.000	0.000	0.9897	0.000	1.000	0.000	0.742	0.3892
CLTV_85_90	0.320	1.377	0.045	2.054	0.1518	0.530	1.699	0.076	5.908	0.0151
CLTV_90_95	0.255	1.290	0.036	1.454	0.2279	0.489	1.631	0.071	5.712	0.0169
CLTV_95_100	0.080	1.083	0.012	0.126	0.7222	0.274	1.315	0.042	1.573	0.2098
CLTV_100_105	0.142	1.152	0.021	0.369	0.5438	0.349	1.418	0.052	2.386	0.1224
CLTV_105_110	0.435	1.544	0.059	0.801	0.3709	0.624	1.866	0.088	1.692	0.1934
CLTV_GT_110	0.975	2.650	0.115	2.964	0.0851	1.359	3.893	0.158	5.930	0.0149
PTI	3.961	52.532	0.560	38.020	<.0001					
WHEN	-0.111	0.895	-0.016	7.478	0.0062	-0.095	0.909	-0.014	5.580	0.0182
-2 Log L	2611.82					2652.018				
LR Chi	411.70	<.0001				371.500	<.0001			
Score Chi	367.68	<.0001				330.675	<.0001			
Pseudo-R2	0.20					0.184				
N	2980					2980				

Table 41 Model of No Roads Needing Repairs

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-3.794	-	-	2.208	0.1373	-2.136	-	-	0.735	0.3914
LN_ZINC_07	0.258	1.295	0.051	5.308	0.0212	0.027	1.028	0.005	0.105	0.7462
LN_HP_07	0.059	1.060	0.012	0.016	0.9003	0.252	1.286	0.050	0.296	0.5866
PER	-0.039	0.962	-0.008	1.365	0.2427	-0.028	0.972	-0.006	0.701	0.4026
HHAGE	0.012	1.012	0.002	8.377	0.0038	0.012	1.012	0.002	8.756	0.0031
MARRIED	0.084	1.087	0.016	0.460	0.4976	0.101	1.106	0.020	0.670	0.4130
FEMALE_HEAD	-0.243	0.785	-0.049	3.406	0.0650	-0.240	0.786	-0.049	3.359	0.0669
HIGH	0.314	1.368	0.065	3.375	0.0662	0.336	1.400	0.071	3.903	0.0482
BACH	0.485	1.624	0.099	6.512	0.0107	0.530	1.699	0.108	7.851	0.0051
PGRAD	0.415	1.515	0.085	3.985	0.0459	0.469	1.599	0.097	5.146	0.0233
BLACK	0.036	1.037	0.007	0.056	0.8124	-0.007	0.993	-0.001	0.002	0.9617
HISPANIC	0.036	1.036	0.007	0.065	0.7983	0.042	1.042	0.008	0.089	0.7655
ASIAN	0.263	1.301	0.050	1.638	0.2006	0.256	1.292	0.049	1.553	0.2127
OTHERS	1.388	4.007	0.209	6.379	0.0115	1.388	4.005	0.209	6.373	0.0116
INTEREST_07	-0.061	0.941	-0.012	3.547	0.0597	-0.049	0.952	-0.010	2.308	0.1287
TERM	0.009	1.009	0.002	1.061	0.3029	0.008	1.008	0.002	0.890	0.3455
GOV	0.066	1.069	0.013	0.411	0.5214	0.066	1.068	0.013	0.403	0.5254
ARM_DUM	-0.233	0.792	-0.047	2.042	0.1530	-0.224	0.799	-0.046	1.899	0.1682
DOWNPAY_07	0.002	1.002	0.000	0.303	0.5819	0.002	1.002	0.000	0.553	0.4572
DOWNPAY_07_SQ	0.000	1.000	0.000	0.054	0.8167	0.000	1.000	0.000	0.317	0.5733
CLTV_85_90	-0.111	0.895	-0.022	0.352	0.5530	-0.029	0.972	-0.006	0.024	0.8767
CLTV_90_95	-0.076	0.927	-0.015	0.182	0.6694	0.010	1.010	0.002	0.003	0.9565
CLTV_95_100	0.073	1.075	0.014	0.140	0.7083	0.139	1.149	0.027	0.521	0.4704
CLTV_100_105	-0.089	0.915	-0.018	0.208	0.6484	-0.016	0.985	-0.003	0.007	0.9358
CLTV_105_110	-0.039	0.962	-0.008	0.010	0.9216	0.032	1.032	0.006	0.006	0.9363
CLTV_GT_110	-0.029	0.972	-0.006	0.005	0.9443	0.089	1.093	0.018	0.048	0.8262
PTI	1.645	5.183	0.325	9.757	0.0018					
WHEN	-0.036	0.965	-0.007	1.117	0.2906	-0.031	0.969	-0.006	0.836	0.3604
-2 Log L	3429.906					3439.780				
LR Chi	335.263	<.0001				325.389	<.0001			
Score Chi	310.305	<.0001				301.267	<.0001			
Pseudo-R2	0.148					0.144				
N	2975					2975				

Table 42 Model of High Neighborhood Rating

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	1.066	-	-	0.164	0.6860	3.750	-	-	2.128	0.1446
LN_ZINC_07	0.630	1.877	0.119	28.688	<.0001	0.215	1.240	0.041	6.079	0.0137
LN_HP_07	1.504	0.222	-0.285	9.920	0.0016	-1.108	0.330	-0.212	5.606	0.0179
PER	-0.048	0.953	-0.009	1.901	0.1679	-0.027	0.973	-0.005	0.625	0.4293
HHAGE	0.004	1.004	0.001	0.865	0.3525	0.005	1.005	0.001	1.171	0.2792
MARRIED	0.403	1.496	0.078	10.688	0.0011	0.432	1.541	0.085	12.423	0.0004
FEMALE_HEAD	0.077	1.080	0.016	0.343	0.5582	0.083	1.087	0.017	0.407	0.5236
HIGH	-0.131	0.877	-0.024	0.517	0.4723	-0.083	0.920	-0.016	0.211	0.6462
BACH	-0.108	0.898	-0.020	0.287	0.5925	-0.020	0.981	-0.004	0.010	0.9217
PGRAD	-0.252	0.778	-0.048	1.312	0.2521	-0.153	0.859	-0.029	0.492	0.4831
BLACK	0.297	1.346	0.055	3.377	0.0661	0.217	1.242	0.041	1.847	0.1742
HISPANIC	0.432	1.540	0.078	8.773	0.0031	0.433	1.542	0.079	8.922	0.0028
ASIAN	-0.086	0.918	-0.017	0.197	0.6570	-0.092	0.912	-0.018	0.230	0.6316
OTHERS	-0.005	0.995	-0.001	0.000	0.9915	-0.003	0.997	-0.001	0.000	0.9950
INTEREST_07	-0.019	0.981	-0.004	0.342	0.5589	0.003	1.003	0.001	0.011	0.9161
TERM	0.004	1.004	0.001	0.230	0.6317	0.003	1.003	0.001	0.112	0.7382
GOV	-0.067	0.935	-0.013	0.410	0.5219	-0.065	0.937	-0.012	0.389	0.5331
ARM_DUM	0.044	1.045	0.008	0.067	0.7960	0.056	1.057	0.011	0.108	0.7430
DOWNPAY_07	0.009	1.009	0.002	7.616	0.0058	0.010	1.010	0.002	9.756	0.0018
DOWNPAY_07_SQ	0.000	1.000	0.000	3.114	0.0776	0.000	1.000	0.000	5.744	0.0165
CLTV_85_90	0.432	1.540	0.076	4.710	0.0300	0.580	1.786	0.104	8.748	0.0031
CLTV_90_95	-0.223	0.800	-0.044	1.555	0.2124	-0.056	0.945	-0.011	0.103	0.7489
CLTV_95_100	0.013	1.013	0.002	0.004	0.9476	0.143	1.154	0.028	0.557	0.4555
CLTV_100_105	0.062	1.064	0.012	0.098	0.7542	0.198	1.219	0.038	1.015	0.3137
CLTV_105_110	-0.552	0.576	-0.114	1.959	0.1616	-0.408	0.665	-0.085	1.093	0.2958
CLTV_GT_110	0.559	1.749	0.096	1.658	0.1979	0.796	2.216	0.136	3.380	0.0660
PTI	2.936	18.834	0.557	28.267	<.0001					
WHEN	0.084	1.087	0.016	5.529	0.0187	0.092	1.096	0.018	6.680	0.0097
-2 Log L	3310.908					3339.983				
LR Chi	312.866	<.0001				283.791	<.0001			
Score Chi	289.636	<.0001				264.386	<.0001			
Pseudo-R2	0.142					0.130				
N	2954					2954				

Table 43 Model of Satisfactory Police Protection

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	3.977	-	-	0.000	0.9933	3.507	-	-	0.000	0.9947
LN_ZINC_07	0.491	1.634	0.021	3.739	0.0531	0.594	1.812	0.026	9.766	0.0018
LN_HP_07	1.255	3.507	0.055	1.464	0.2263	1.157	3.180	0.050	1.270	0.2597
PER	-0.145	0.865	-0.006	5.760	0.0169	-0.149	0.862	-0.007	6.158	0.0131
HHAGE	-0.008	0.993	-0.000	0.771	0.3798	-0.008	0.993	-0.000	0.778	0.3777
MARRIED	0.124	1.132	0.006	0.228	0.6329	0.119	1.126	0.006	0.212	0.6455
FEMALE_HEAD	0.377	1.459	0.016	1.553	0.2126	0.382	1.465	0.016	1.592	0.2071
HIGH	0.311	1.365	0.015	1.049	0.3058	0.296	1.345	0.015	0.960	0.3271
BACH	0.427	1.533	0.020	1.372	0.2414	0.404	1.498	0.019	1.242	0.2652
PGRAD	0.478	1.613	0.022	1.330	0.2489	0.453	1.573	0.021	1.205	0.2723
BLACK	-0.061	0.941	-0.003	0.035	0.8522	-0.033	0.968	-0.001	0.010	0.9193
HISPANIC	-0.058	0.944	-0.003	0.044	0.8345	-0.058	0.944	-0.003	0.043	0.8358
ASIAN	-0.100	0.905	-0.004	0.058	0.8097	-0.091	0.913	-0.004	0.049	0.8252
OTHERS	21.126	>999.999	0.050	0.008	0.9311	23.346	>999.999	0.050	0.003	0.9578
INTEREST_07	-0.015	0.985	-0.001	0.045	0.8323	-0.020	0.981	-0.001	0.078	0.7803
TERM	0.004	1.004	0.000	0.059	0.8074	0.005	1.005	0.000	0.071	0.7895
GOV	0.238	1.269	0.010	1.159	0.2816	0.238	1.269	0.010	1.157	0.2820
ARM_DUM	0.345	1.413	0.013	0.736	0.3909	0.346	1.413	0.013	0.740	0.3896
DOWNPAY_07	-0.014	0.986	-0.001	2.254	0.1333	-0.014	0.986	-0.001	2.323	0.1275
DOWNPAY_07_SQ	0.000	1.000	0.000	2.700	0.1003	0.000	1.000	0.000	2.839	0.0920
CLTV_85_90	-0.053	0.949	-0.002	0.013	0.9091	-0.081	0.922	-0.002	0.031	0.8599
CLTV_90_95	-0.175	0.839	-0.006	0.162	0.6878	-0.212	0.809	-0.007	0.239	0.6248
CLTV_95_100	-1.095	0.335	-0.052	5.911	0.0150	-1.121	0.326	-0.053	6.254	0.0124
CLTV_100_105	-0.868	0.420	-0.037	3.373	0.0663	-0.897	0.408	-0.039	3.632	0.0567
CLTV_105_110	-1.011	0.364	-0.046	1.362	0.2431	-1.043	0.353	-0.048	1.460	0.2270
CLTV_GT_110	-1.209	0.298	-0.060	1.705	0.1917	-1.250	0.286	-0.062	1.841	0.1748
PTI	-0.655	0.520	-0.028	0.383	0.5360					
WHEN	-0.043	0.958	-0.002	0.317	0.5735	-0.045	0.957	-0.002	0.338	0.5610
-2 Log L	946.027					946.408				
LR Chi	211.656	0.0126				211.275	0.0115			
Score Chi	216.686	0.0067				215.676	0.0066			
Pseudo-R2	0.214					0.213				
N	2904					2904				

Table 44 Model of Neighborhood Stores within 15 Minutes

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-0.405	-	-	0.009	0.9241	-3.201	-	-	0.590	0.4423
LN_ZINC_07	-0.425	0.654	-0.041	6.799	0.0091	-0.049	0.952	-0.005	0.171	0.6796
LN_HP_07	1.063	2.894	0.103	1.790	0.1809	0.790	2.203	0.077	1.003	0.3165
PER	0.032	1.032	0.003	0.350	0.5539	0.007	1.007	0.001	0.021	0.8863
HHAGE	-0.001	0.999	0.000	0.039	0.8429	-0.001	0.999	0.000	0.046	0.8302
MARRIED	-0.318	0.728	-0.030	2.666	0.1025	-0.321	0.725	-0.030	2.744	0.0976
FEMALE_HEAD	-0.172	0.842	-0.015	0.650	0.4200	-0.179	0.837	-0.016	0.710	0.3993
HIGH	-0.789	0.454	-0.068	5.963	0.0146	-0.818	0.441	-0.069	6.465	0.0110
BACH	-0.451	0.637	-0.035	1.708	0.1912	-0.524	0.592	-0.040	2.327	0.1272
PGRAD	-0.561	0.571	-0.045	2.364	0.1241	-0.656	0.519	-0.053	3.273	0.0704
BLACK	0.187	1.206	0.017	0.583	0.4452	0.258	1.295	0.023	1.116	0.2908
HISPANIC	-0.147	0.863	-0.015	0.474	0.4914	-0.173	0.841	-0.018	0.667	0.4141
ASIAN	-0.334	0.716	-0.035	1.526	0.2166	-0.338	0.713	-0.036	1.582	0.2085
OTHERS	0.579	1.784	0.047	0.389	0.5329	0.621	1.860	0.050	0.448	0.5033
INTEREST_07	0.280	1.323	0.027	25.805	<.0001	0.251	1.286	0.025	21.677	<.0001
TERM	-0.013	0.987	-0.001	1.021	0.3124	-0.011	0.989	-0.001	0.748	0.3872
GOV	0.073	1.075	0.007	0.220	0.6391	0.085	1.089	0.008	0.299	0.5847
ARM_DUM	-0.331	0.718	-0.035	2.154	0.1422	-0.345	0.708	-0.037	2.352	0.1251
DOWNPAY_07	-0.014	0.986	-0.001	5.709	0.0169	-0.017	0.983	-0.002	8.162	0.0043
DOWNPAY_07_SQ	0.000	1.000	0.000	4.599	0.0320	0.000	1.000	0.000	6.932	0.0085
CLTV_85_90	0.181	1.198	0.015	0.383	0.5358	0.008	1.008	0.001	0.001	0.9787
CLTV_90_95	-0.068	0.934	-0.006	0.059	0.8083	-0.248	0.781	-0.023	0.814	0.3669
CLTV_95_100	-0.420	0.657	-0.043	1.905	0.1675	-0.570	0.566	-0.057	3.592	0.0581
CLTV_100_105	-0.254	0.776	-0.025	0.614	0.4332	-0.433	0.649	-0.042	1.845	0.1744
CLTV_105_110	0.100	1.106	0.009	0.021	0.8838	-0.104	0.901	-0.009	0.023	0.8785
CLTV_GT_110	-1.255	0.285	-0.157	3.569	0.0589	-1.521	0.218	-0.194	5.351	0.0207
PTI	-2.806	0.060	-0.273	12.187	0.0005					
WHEN	0.270	1.310	0.026	23.335	<.0001	0.253	1.288	0.025	20.807	<.0001
-2 Log L	1797.355					1809.474				
LR Chi	351.656	<.0001				339.537	<.0001			
Score Chi	340.710	<.0001				330.563	<.0001			
Pseudo-R2	0.221					0.213				
N	2788					2788				

Table 45 Model of No Serious Neighborhood Crime

	Coeff.	O.R.	A.M.E	Chi-sq	p-value	Coeff.	O.R.	A.M.E	Chi-sq	p-value
Intercept	-2.345	-	-	0.453	0.5007	0.168	-	-	0.002	0.9606
LN_ZINC_07	0.680	1.974	0.070	18.682	<.0001	0.306	1.358	0.032	6.556	0.0105
LN_HP_07	-0.568	0.567	-0.058	0.816	0.3662	-0.208	0.812	-0.022	0.114	0.7358
PER	-0.101	0.904	-0.010	5.263	0.0218	-0.085	0.918	-0.009	3.763	0.0524
HHAGE	0.001	1.001	0.000	0.049	0.8257	0.002	1.002	0.000	0.101	0.7510
MARRIED	0.180	1.197	0.018	1.131	0.2875	0.223	1.250	0.023	1.754	0.1854
FEMALE_HEAD	-0.104	0.901	-0.012	0.353	0.5526	-0.099	0.906	-0.011	0.318	0.5730
HIGH	0.098	1.103	0.010	0.160	0.6890	0.136	1.146	0.015	0.314	0.5753
BACH	0.149	1.161	0.015	0.299	0.5846	0.223	1.249	0.023	0.673	0.4120
PGRAD	-0.119	0.888	-0.013	0.165	0.6842	-0.025	0.976	-0.003	0.007	0.9322
BLACK	-0.352	0.703	-0.044	3.356	0.0670	-0.415	0.660	-0.052	4.757	0.0292
HISPANIC	0.794	2.213	0.070	14.683	0.0001	0.794	2.211	0.070	14.735	0.0001
ASIAN	0.692	1.998	0.063	4.967	0.0258	0.649	1.914	0.060	4.419	0.0356
OTHERS	0.275	1.317	0.028	0.171	0.6792	0.261	1.298	0.027	0.154	0.6944
INTEREST_07	-0.083	0.920	-0.009	3.581	0.0585	-0.064	0.938	-0.007	2.092	0.1481
TERM	0.004	1.004	0.000	0.090	0.7642	0.002	1.002	0.000	0.018	0.8921
GOV	0.107	1.113	0.011	0.558	0.4549	0.119	1.126	0.012	0.688	0.4070
ARM_DUM	0.153	1.165	0.015	0.420	0.5168	0.140	1.151	0.014	0.359	0.5492
DOWNPAY_07	0.007	1.007	0.001	3.250	0.0714	0.006	1.006	0.001	3.106	0.0780
DOWNPAY_07_SQ	0.000	0.000	0.000	2.031	0.1541	0.000	1.000	0.000	2.578	0.1084
CLTV_85_90	0.123	1.131	0.013	0.220	0.6391	0.236	1.266	0.024	0.824	0.3639
CLTV_90_95	0.161	1.175	0.016	0.444	0.5054	0.284	1.329	0.029	1.416	0.2341
CLTV_95_100	0.049	1.050	0.005	0.038	0.8451	0.123	1.130	0.013	0.242	0.6229
CLTV_100_105	0.107	1.113	0.011	0.195	0.6592	0.190	1.209	0.020	0.618	0.4319
CLTV_105_110	-0.182	0.834	-0.021	0.140	0.7086	-0.100	0.905	-0.011	0.042	0.8373
CLTV_GT_110	0.015	1.015	0.002	0.001	0.9759	0.145	1.157	0.016	0.085	0.7711
PTI	2.650	14.159	0.273	13.187	0.0003					
WHEN	-0.029	0.047	-0.003	0.374	0.5407	-0.021	0.979	-0.002	0.204	0.6519
-2 Log L	2020.951					2034.590				
LR Chi	277.047	<.0001				263.408	<.0001			
Score Chi	256.264	<.0001				245.342	<.0001			
Pseudo-R2	0.165					0.158				
N	2968					2968				

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